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Popular Science Monthly

JUNE, 1920

Volume 96-No. 6

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A Startling Memory Feat That You Can Do

How I learned the secret in one evening. It has helped me every day

WHEN my old friend Faulkner invited me to a dinner party at his house, I little thought it would be the direct means of getting me a one-hundred-and-fifty per cent increase in salary. Yet it was, and here is the way it all came about.

Toward the close of the evening things began to drag a bit, as they often do at parties. Finally some one suggested the old idea of having everyone do a "stunt." Some sang, others forced weird sounds out of the piano, recited, told stories, and so on.

Then it came to Macdonald's turn. He was a quiet sort of chap, with an air about him that reminded one of the old saying that "still waters run deep." He said he had a simple "stunt" which he hoped we would like. He selected me to assist him. First he asked to be blindfolded securely to prove there was no trickery in it. Those present were to call out twenty-five numbers of three figures each, such as 161, 249, and so on. He asked me to write down the numbers as they were called.

This was done. Macdonald then astounded everyone by repeating the entire list of twenty-five numbers backwards and forwards. Then he asked people to request numbers by positions, such as the eighth number called, the fourth number, and so on. Instantly he repeated back the exact number in the position called. He did this with the entire list—over and over again, without making a single mistake.

Then Macdonald asked that a deck of cards be shuffled and called out to him in their order. This was done. Still blindfolded, he instantly named the cards in their order backwards and forwards. And then to further amaze us, he gave us the number of any card counting from the top, or the card for any number.

You may well imagine our amazement at Macdonald's remarkable feat. You naturally expect to see a thing of this sort on the stage, even then you look upon it as a trick. But to see it done by an everyday business man, in plain view of everyone, blindfolded and under conditions which make trickery impossible, is astonishing, to say the least.

ON the way home that night I asked Macdonald how it was done. He said there was really nothing to it—simply a memory feat, the key to which anyone could easily learn in one evening. Then he told me that the reason most people have had memories is because they leave memory development to chance. Anyone could do what he had done, and develop a good memory, he said, by following a few simple rules. And then he told me exactly how to do it. At the time I little thought that evening would prove to be one of the most eventful in my life, but such it proved to be.

What Macdonald told me I took to heart. In one evening I made remarkable strides toward improving my memory and it was, but a question of days before I learned to do exactly what he had done. At first I amused myself with my new-found ability by amazing people at parties. My "memory feat," as my friends called it, surely made a hit. Everyone was talking about it, and I was showered with invitations for all sorts of affairs. If anyone were to ask me how quickly to develop social popularity, I would tell him to learn my memory "feat"—but that is apart from what I want to tell you.

The most gratifying thing about the improvement

of my memory was the remarkable way it helped me in business. Much to my surprise I discovered that my memory training had literally put a razor edge on my brain. My brain had become clearer, quicker, keener. I felt that I was fast acquiring that mental grasp and alertness I had so often admired in men who were spoken of as "wonders" and "geniuses."

The next thing I noticed was a marked improvement in my conversational powers. Formerly my talk was halting and disconnected. I never could think of things to say until the conversation was over. And then, when it was too late, I would always think of apt and striking things I "might have said." But now I can think like a flash. When I am talking I never have to hesitate for the right word, the right expression or the right thing to say. It seems that all I have to do is to start to talk instantly I find myself saying the very thing I want to say to make the greatest impression on people.

It wasn't long before my new-found ability to remember things and to say the right thing at the right time attracted the attention of our president. He got in the habit of calling me in whenever he wanted facts about the business. As he expressed himself to me, "You can always tell me instantly what I want to know, while the other fellows answer me by dodging out of the office and saying 'I'll look it up.'"

I FOUND that my ability to remember helped me wonderfully in dealing with other people, particularly in committee meetings. When a discussion opens up the man who can back up his statements quickly with a string of definite facts and figures usually dominates the others. Time and time again I have won people to my way of thinking simply because I could instantly recall facts and figures. While I'm proud of my triumphs in this respect, I often feel sorry for the ill-at-ease look of the other men who cannot hold up their end in the argument because they cannot recall facts instantly. It seems as though I never forget anything. Every fact I now put in my mind is as clear and as easy to recall instantly as though it were written before me in plain black and white.

We all hear a lot about the importance of sound judgment. People who ought to know say that a man cannot begin to exercise sound judgment until he is forty to fifty years of age. But I have disproved all that. I have found that sound judgment is nothing more than the ability to weigh and judge facts in their relation to each other. Memory is the basis of sound judgment. I am only thirty-two, but many times I have been complimented on having the judgment of a man of forty-five. I take no personal credit for this—it's all due to the way I trained my memory.

THESE are only a few of the hundreds of ways I have profited by my trained memory. No longer do I suffer the humiliation of meeting men I know and not being able to recall their names. The moment I see a man his name flashes to my mind, together with a string of facts about him. I always liked to read but usually forgot most of it. Now I find it easy to recall what I have read. Another surprising thing is that I can now master a subject in considerably less time than before. Price lists, market quotations, data of all kinds, I can recall in detail almost at will. I rarely make a mistake.

My vocabulary, too, has increased wonderfully. Whenever I see a striking word or expression, I memorize it and use it in my dictation or conversation. This has put a remarkable sparkle and pulling power into my conversation and business letters. And the remarkable part of it all is that I can now do my day's work quicker, and with much less effort, simply because my mind works like a flash and I do not have to keep stopping to look things up.

All this is extremely satisfying to me, of course.



But the best part of it all is that since my memory power first attracted the attention of our president, my salary has steadily been increased. Today it is many times greater than it was the day Macdonald got me interested in improving my memory.

WHAT Macdonald told me that eventful evening was this: "Get the Roth Memory Course." I did. That is how I learned to do all the remarkable things I have told you about. The publishers of the Roth Memory Course—the Independent Corporation—are so confident that it will also show you how to develop a remarkable memory that they will gladly send the Course to you on approval.

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June, 1920

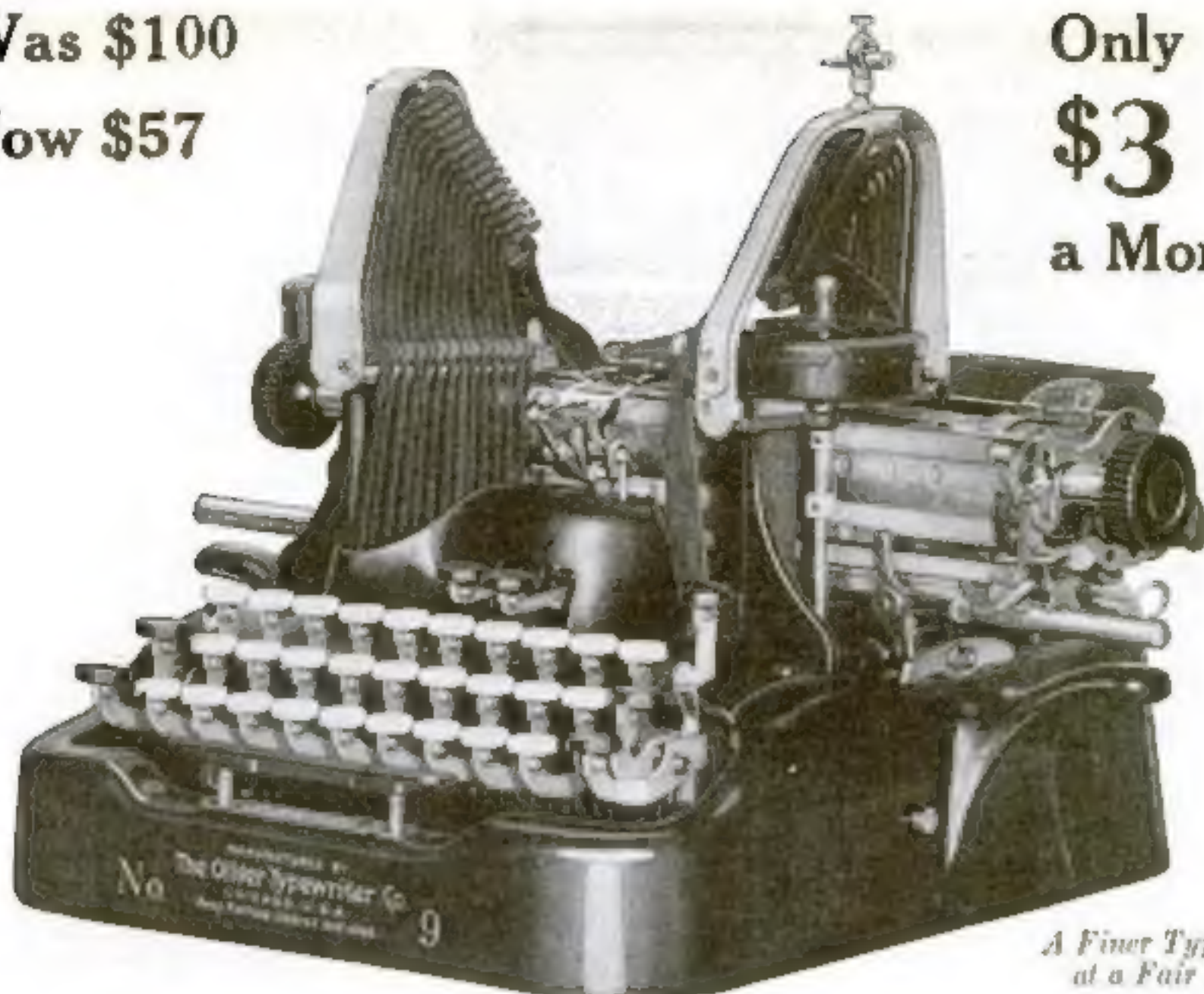
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Never before have there been so many splendid opportunities for trained accountants—men whose training combines a knowledge of Auditing, Cost Accounting, Business Law, Organization, Income Tax Work, Management and Finance. Few professions offer better opportunities to young men of ambition and intelligence. The tremendous business growth of this country has created a rich field for the expert. There are only about 3,000 Certified Public Accountants to do the work of the half million concerns needing proficient accounting service. The expert accountant is needed today in every big business organization.

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Mail the coupon now and get our free book which fully describes our expert training course and tells all about our Money-Back Guarantee, C. P. A. examinations, state regulations, salaries and incomes, and how you can qualify for a high-grade accounting position without interference with your present position. Send in the coupon and find out how we have helped over 200,000 ambitious men, and learn what we can do for you.

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A prominent Chicago executive says: "Get this book 'Ten Years' Promotion in One' even if it costs you \$1.00 for a copy." Let us send it to you free, with literature explaining how you can train for a Higher Accountancy job without interference with your present duties. Send coupon today—NOW.



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"The Latest Business Training Institution in the World"
Dept. 683-H Chicago, Illinois

Send at once, without cost or obligation to me, your valuable book, "Ten Years' Promotion in One," also your book of Accountancy Facts and full details of your course in Higher Accounting.

Name.....

Present Position.....

Address.....



SELLING SECRETS That Bring This Man \$10,000 a Year

FROM fireman on an Eastern railroad to \$10,000 a-year Star Salesman in one jump! P. T. Balsbaugh whose picture appears above did it! He's taken his place in the ranks of the big money makers. \$10,000 a year as a Salesman—and he never sold goods before!

How did he do it? Simply by learning the secrets of successful salesmanship from Master Salesmen and Sales Managers through the National Salesmen's Training Association.

Think what you could do with his splendid income! You could own your own home, have money in the bank, drive a car and have many of the luxuries that make life worth living. What Balsbaugh did, you too can do.

Why Don't YOU Get into the Selling Game?

The quickest way to earn big money is in the selling game. Be a Star Salesman. You can learn the secrets of selling as thousands have done. Our amazing methods make mastery of Salesmanship easy for any man who wants to succeed. You don't have to lose a day or a dollar from your present job—just a part of your spare time will do.

FREE Proof that You Can Be a Star Salesman

Mail the coupon below. It will bring you a wonderful book entitled "A Knight of the Grip." In it you will find the proof that you, too, can do as Balsbaugh did, as thousands have done through this System. See for yourself the wonderful opportunities in this fascinating profession. Learn how you can quickly qualify.

We Help You Land a Selling Job

No long apprenticeship by this wonderful system. Just as soon as you are ready and qualified the Employment and Service Department of the N. S. T. A. will help you select and secure a good selling position. The moment you are a Salesman your chances for making money are unlimited.

Lost no time! Mail the coupon right now—this minute. Address:

National Salesmen's Training Association
Dept. 15-G Chicago, Ill., U. S. A.

National Salesmen's Training Association
Dept. 15-G, Chicago, Ill., U. S. A.

With no obligation on my part, please send me "A Knight of the Grip" and full information about the N. S. T. A. Training and Employment Service. Also a list showing lines of business with openings for salesmen.

Name.....

Street.....

City.....

State.....



Free Proof that I Can Raise Your Pay

No matter how much you are earning now, I can show you how to increase it. I have even taken failures and shown them how to make \$100—\$200, and in one case as high as \$2,000 weekly. I am willing to prove this entirely at my risk and expense.

LET'S have a little chat about getting ahead—you and I. My name is Pelton. Lots of people call me "The Man Who Makes Men Rich." I don't deny it. I've done it for thousands of people—lifted them up from poverty to riches.

I'm no genius—far from it. I'm just a plain, everyday, unassuming sort of man. I know what poverty is. I've looked black despair in the eye—had failure stalk me around and hoodoo everything I did. I've known the bitterest kind of want.

But today all is different. I have money and all of the things that money will buy. I am rich also in the things that money won't buy—health, happiness and friendship. Few people have more of the blessings of the world than I.

IT was a simple thing that jumped me up from poverty to riches. As I've said, I'm no genius. But I had the good fortune to know a genius. One day this man told me a "secret." It had to do with getting ahead and growing rich. He had used it himself with remarkable results. He said that every wealthy man knew this "secret"—that is why he was rich.

I used the "secret." It surely had a good test. At that time I was flat broke. Worse than that, for I was several thousand dollars in the hole. I had about given up hope when I put the "secret" to work.

At first I couldn't believe my sudden change in fortune. Money actually flowed in on me. I was thrilled with a new sense of power. Things I couldn't do before became as easy for me to do as opening a door. My business boomed and continued to leap ahead at a rate that startled me. Prosperity became my partner. Since that day I've never known what it is to want for money, friendship, happiness, health or any of the good things of life.

That "secret" surely made me rich in every sense of the word.

MY sudden rise to riches naturally surprised others. One by one people came to me and asked me how I did it. I told them. And it worked for them as well as it did for me.

Some of the things this "secret" has done for people are astounding. I would hardly believe them if I hadn't seen them with my own eyes. Adding ten, twenty, thirty or forty dollars a week to a man's income is a mere nothing. That's merely playing at it. In one case I took a rank failure and in a few weeks had him earning as high as \$2,000.00 a week. Listen to this:

A young man in the East had an article for which there was a nation-wide demand. For twelve years he "pattered around" with it, barely eking out a living. Today this young man is worth \$200,000. He is building a \$25,000 home—and paying cash for it. He has three automobiles. His children go to private schools. He goes hunting, fishing, traveling whenever the mood strikes him. His income is over a thousand dollars a week.

In a little town in New York lives a man who two years ago was pitted by all who knew him. From the time he was 14 he had worked and slaved—and at sixty he was looked upon as a failure. Without work—in debt to his charitable friends, with an invalid son to support, the outlook was pitchy black.

Then he learned the "secret." In two weeks he was in business for himself. In three months his plant was working night and day to fill orders. During 1916 the profits were \$20,000. During 1917 the profits ran close to \$40,000. And this genial 64-year-old man is enjoying pleasures and comforts he little dreamed would ever be his.

I COULD tell you thousands of similar instances. But there's no need to do this as I'm willing to tell you the "secret" itself. Then you can put it to work and see what it will do for you.

I don't claim I can make you rich over night. Maybe I can—maybe I can't. Sometimes I have failures—everyone has. But I do claim that I can help 90 out of every 100 people if they will let me.

The point of it all, my friend, is that you are using only about one-tenth of that wonderful

brain of yours. That's why you haven't won greater success. Throw the unused nine-tenths of your brain into action and you'll be amazed at the almost instantaneous results.

The Will is the motive power of the brain. Without a highly trained, inflexible will, a man has about as much chance of attaining success in life as a railway engine has of crossing the continent without steam. The biggest ideas have no value without will-power to "put them over." Yet the will, altho heretofore entirely neglected, can be trained into wonderful power like the brain or memory and by the very same method—intelligent exercise and use.

If you held your arm in a sling for two years it would become powerless to lift a feather from lack of use. The same is true of the Will—it becomes useless from lack of practice. Because we don't use our Will—because we continually bow to circumstances—we become unable to assert ourselves. What our wills need is practice.

Develop your will power and money will flow in on you. Rich opportunities will open up for you. Driving energy you never dreamed you had will manifest itself. You will thrill with a new power—a power that nothing can resist. You'll have an influence over people that you never thought possible. Success—in whatever form you want it—will come as easy as failure came before. And these are only a few of the things the "secret" will do for you. The "secret" is fully explained in the wonderful book "Power of Will."

How You Can Prove This at My Expense

I KNOW you'll think that I've claimed a lot. Perhaps you think there must be a catch somewhere. But here is my offer. You can easily make thousands—you can't lose a penny.

Send no money—no, not one cent. Merely clip the coupon and mail it to me. By return mail you'll receive just a pamphlet, but the whole "secret" told in this wonderful book "POWER OF WILL."

Keep it five days. Look it over in your home. Apply some of its simple teachings. If it doesn't show you how you can increase your income many times over—just as it has for thousands of others—mail the book back. You will be out nothing.

But if you feel that "POWER OF WILL" will do for you what it has done for over four hundred thousand others—if you feel as they do that it is the best investment book in the world—send me only \$3.50 and you and I'll be square.

If you pass this offer by, I'll be out only the small profit on a \$3.50 sale. But you—you may easily be out the difference between what you're making now and an income several times as great. So you see you've a lot—a whole lot—more to lose than I.

Mail the coupon or write a letter now—you may never read this offer again.

SPECIAL NOTE

In nearly five years the price of "Power of Will" has been advanced only once. It's paid a necessary debt to raise the price to \$4.50 as soon as the present edition is gone. This means that by July 1st or sooner, the price must be increased to \$4.50.

Pelton Publishing Company
14-K Wilcox Block Meriden, Conn.

Pelton Publishing Company
14-K Wilcox Block, Meriden, Conn.

You may send me "Power of Will" at your risk. I agree to refund \$4.50 or resell the book to you in five days.

Name.....

Address.....

A Few Examples

Persons' Experiences

Among the 400,000 users of "Power of Will" are such men as Justice Ben H. Lindsey, Supreme Court Justice Parker, Wm. T. Ford, Ex-U. S. Chinese Ambassador, Assistant Postmaster General Felix Gov. McKelvie of Nebraska, General Manager, Chairman of Wells-Fargo Express Co., E. M. Elms Lewis, former Vice-pres. Art Metal Construction Co., Gov. Ferris of Michigan, E. T. Meredith, Sec. of Agriculture, and many others of equal prominence.

\$300 Profit from One Day's Reading

"The result of one day's study netted me \$300 in cash. I think it a great bonus and would not be without it for ten times the cost."—Col. S. W. Wilkie, Hamon, S. Dakota.

Worth \$15,000 and More
"The book has been worth more than \$15,000 to me."—Oscar B. Sheppard.

Would Be Worth \$100,000
"If I only had it when I was 20 years old, I could be worth \$100,000 today. It is worth a hundred times the price."—J. W. Taylor, the Sante Fe Ry., El Paso, Texas.

Salary Jumped from \$100 to \$400

"Since I read Power of Will my salary has jumped from \$100 to \$400 a month."—J. P. Gilman, San Diego, Cal.

From \$100 to \$1,000 a Month

"One of our boys who read Power of Will before he came over here has jumped from \$100 a month to \$1,000 the first month, and won a \$250 prize for the best salesmanship in the state."—Private Leslie A. Stahl, A. E. F. France.

QUICK-ACTION ADVERTISING

HERE READERS AND ADVERTISERS MEET TO TRANSACT BUSINESS

Rate 25 Cents a Word, no discounts.

Advertisements for the August issue should be received by June 1st.

AUTOMOBILES AND ACCESSORIES

AUTO Motor Supplies. Buick, Michigan, Hindard Darton, Hupp 22, Cadillac, Overland, S. M. P., Continental and Buick Motors, all types, \$50 each and up. Bosch Magneto, \$15 each and up. Special high tension 2 and 4 cylinder magneto, \$9.50 each. Press-1-Like tanks, \$5.00. Cylinders, carburetors, air compressors, generators, starters, etc. Write for Bargain Bulletin. Second hand auto accessories. Address Motor Sales, Dept. 14, West End, Pittsburgh, Pennsylvania.

SALESMEN—Agents—Everywhere. Sell "Tank" Modern auto-tires. Guaranteed, 100 to 200% profit. Every automist interested. Kansas territory. Tank, Cleveland, Ohio.

AUTOMOBILE Parts for all cars—50% off manufacturers' list price. Pistons, connecting rods, cam shafts, crank shafts, cylinders, axles and gears. Our new catalog and Best Parts Bulletin now ready. Write for it today. Service and satisfaction guaranteed. Auto Parts Company, 4106 Olive Street, St. Louis, Missouri.

TIRE. Factory-to-You Prices. Exclusive representative wanted each locality to sell and sell Midinger Extra Fly Tires. Guarantee Good 5000 Miles. Sample sections furnished. Midinger Tire Company, 937 Oak Street, Kansas City, Missouri.

VULCANIZING auto tires is a growing and profitable business. Easy to learn. Instruction book, \$1. Plants \$50 to \$100. Details free. Equipment Co., 17 Canal, Cincinnati, Ohio.

HYDRONIZER. Insures clean plugs, maximum carbon, saves gasoline, increases power and increases speed. For all cars. Money back guarantee. Big profits for agents. Free literature. Friedberg Manufacturing Company, 2035 West Lake Street, Chicago.

PATENTS. Write for Free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch and description of invention for our opinion of its patentable nature. Highest references. Reasonable terms. Victor J. Evans & Company, 150 Ninth, Washington, D. C.

INSIDE TYRES. Inner armor for Automobile Tires. prevents punctures and doubles mileage of any tire. Liberal profits. Details free. American Automobile Co., Dept. 27-A, Cincinnati, Ohio.

RED DEVIL Auto Polish. Brightens the way. Repairs film, cam, lac to introduce. Agents wanted. Red Devil Products, Dept. 1, Farmingdale, New York.

CHILDREN can fix punctures with Kinsey's Elastic Patch. Instantaneous—Permanent—Guaranteed. Mailed, prepaid for dollar bill. Kinsey Patch Company, Junction, Mo., Kansas.

WINELO—Unexcelled Auto Body Polish. Formosa, \$1.00. A top dressing formula from John Klerke, West Water, Chillicothe, Ohio.

MR. ADVERTISER. Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

VULCANIZING. Our circular tells how to make liberal out-patches from used tire fabric. C. M. Anderson, Havana, Illinois.

BULL dog inner tires modified to fit your car. Practically eliminates blow-outs and punctures. Doubles the life of your tires. Wonderful value and repeat order getter. Write for particulars to-day. Agents making \$1,000 to \$10,000 a year. Eastern Auto Specialty Co., Dept. 3, Ulen, New York.

RACING body at little cost, build it yourself. Send \$20 for instructions and blueprint. F. Flanagan, Box 321, Nord Chicago, Illinois.

BLUEPRINTS of connections for armatures of synchronous starters, generators, and motor-generators. See ad under "Electrical," Charles Christensen.

TIRES at wholesale. We have the cheapest high-grade, long life and reliable tires in the world. No "seconds" or rebuffs. Send for prices. Overton Tire Company, Oskema, Iowa.

BUILD your own garage. Blueprints, instruction, list of material needed, \$2. Money refunded if not satisfactory. Al Violet, 52 Park Street, Providence, Rhode Island.

WELDING AND SOLDERING

DON'T scrap aluminum parts. Save them with Sol-Luminum. New, great "2-in-1" welding, brazing and soldering compound, stronger than aluminum—perfect substitute for acetylene welding—4. One and one-half lbs. of this torch or soldering iron. No flux. Box \$1.00. Sample box \$1.00. Used by United States Army and Navy, featured by British Munitions Board. Sol-Luminum Manufacturing Company, 1700 Broadway, New York.

WELDING PLANTS, \$25.00 to \$200.00. Designed for all purposes. Mount cash payment, balance three to six months. Every mechanic or shop should have one. Dermo Welding Co., Omaha, U. S. A.

20TH Century Aluminum Welding Metal, repairs anything in aluminum, used exclusively by several automobile manufacturers, garages, etc. Sample \$1.00; \$3.00 in. Fully guaranteed. Chas. Mead, 1025 Holmes Street, Lansing, Michigan.

SOLDERING paste for soldering aluminum with ordinary solder works on this sheet or large castings. \$1.00 a can. Warner Supply Company, 134 South Durand Street, Kalamazoo, Michigan.

WIRELESS

SIMPLE Wireless Telephones and How to Make Them. A good book for the advanced radio amateur on the principles, construction and use of the wireless telephones. Price 35 cents postpaid. Book Dept., Popular Science Monthly, 225 West 39th Street, New York.

"SILVERPLATE" without electricity. Bottle "Silverplate" 25c. Roberts, 11/12 Detroit Avenue, Cleveland, Ohio.

FORD ACCESSORIES

FORD Speed-Power Equipment stocked. 4 speeds forward secondary transmissions, double pulling power, 30-cubic-inch 40 or 50% 1.16 valve overhead cylinder head, speed carburetors, crankshaft counterbalances, high tension magneto, underdriving features, speed power belt drive, front axle drive, steering wheels, wire wheels, disc wheels, metal wheel discs, Ford fire chemical tank and holder, 12" 50" double universal wheelbase extension, 1-4 in. long side spring additional frame work and; complete five 1-4 in. shaft-chain drive unit; racing bodies; complete racing cars, \$300 to \$1,150. Special—Instantaneous Electric Hot Water Heater, attachable any faucet. Retail \$60. Dealers \$45. F. Ford Speed-Power Equipment Manufacturers, 250 West 34th Street, New York City.

FORD run 34 miles per gallon with our 1926 carburetors. Use cheapest gasoline or kerosene. Start easy any weather. Increased power. Styles for all models. Runs slow in high gear. Attach yourself. Big profits for agents. Money back guarantee, 30 days' trial. Air-Ford Carburetor Company, 280 Madison Avenue, Dartmouth, Ohio.

The Best Out of Forty

Popular Science Monthly,
225 West 39th Street,
New York City.

Gentlemen:

We advertise in more than forty publications, and keep a full record of each one. Your publication has paid us better than any other magazine we use. Not only do first returns cost less, but we get a larger percentage of second returns. A number of our best regular customers were introduced to us by Popular Science Monthly.

Very truly yours,

CHAMBERS PRINTING WORKS

If you would like to know what other advertisers think and say about "Quick Action Advertising" in Popular Science Monthly, ask us for the REAL proof. We have hundreds of letters from satisfied and successful advertisers in every part of America—men who have learned, by actual experience, that Popular Science Monthly PAYS. Their knowledge should be of special value to you in choosing a list of mediums for your advertising. Why not learn what they have to say, profit by their wisdom and spare yourself costly experimentation? Ask us today!

Classified Advertising Manager

POPULAR SCIENCE MONTHLY
225 West 39th Street
New York City

FORD double the mileage with Ford Carburetors. Easy starting. Double the power. Satisfaction absolutely guaranteed. Free trial. Agents wanted. York Sales Company, Dept. 14, 1514 East Jefferson Avenue, Detroit, Michigan.

TIMER Break. New wiping contact, quick starting, instant running. Only 34 cents, prepaid. K. Sp. Works, Box 145, Riverside, California.

SAVE-ALL Carburetor Attachment makes Ford run better. Great more miles, power and speed. Free trial. Sayall Company, 3718 North Clark Street, Chicago.

OUR Spark Igniter fires all four cylinders with cracked or worn out plugs. Boosts engine troubles instantly and makes your car start easier. Send one dollar for sample and liberal agents proposition. Crutcher Company, Box 678, Seattle, Washington.

FOUR Dollars insure you for life against being killed by your Ford. Write to-day for our free booklet "Easy-Kick," the safety device for Ford. Easily attached. Bellum Tool Company, Louisiana, Missouri.

"SURE-FIT Timers," \$4.00. Something different and guaranteed in writing for two years when used with the J. W. Jones Plug, \$3.50. (Not a spark plug.) Both sent prepaid for \$7.00. If you more than doubled with results, we will cheerfully refund your money. Omaha Accessory Company, 1013 Douglas Street, Omaha, Nebraska.

MOTORCYCLES, BICYCLES, SUPPLIES

MOTORCYCLES all makes, \$25.00 up. New bicycles at big reductions. Second hand, \$5.00 up. Motors, motor attachments, Cycle Motors, Smith motor wheels, etc., \$30.00 up. New parts to fit all makes carried in stock. Lowest hand parts good as new 50% discount. Expert repairing on magneto, generators, transmissions. Motors overhauled \$10.00 up. Henderson motors our specialty. Write for big bargain bulletin. American Motor Cycle Company, Dept. 3, Chicago.

REBUILT motorcycles at half cost of new machines. Write for spring bulletin. Western Supplies Company, 371 Ilkuth Building, Denver, Colorado.

\$25.00 Up—Guaranteed rebuilt motorcycles—Henderson, Excelsior, Indian, Harley-Davidson. Bicycles, \$5.00 up. Tires and accessories at wholesale. Illustrated bulletin "A" free. Ask Motor Corporation, 163 North Clinton Avenue, Rochester, New York.

USED Motorcycle Bargains. Indian, Excelsior, Harleys, \$40.00 up. Singles or twins. Overhauled, rebuilt and tested by experts. Shipped on approval and guaranteed. Send stamp for Big Free List. We furnish back reference. Ford Cycles, Dept. A. "Largest Motorcycle Dealer in Western America." Denver, Colorado.

REBUILT Motorcycles—New 1926 Spring Run Harley-Davidsons, Indians, Excelsiors, Hendersons, and others \$50.00 to \$175.00. Every machine rebuilt and guaranteed as represented. Write for new folder B. Carl W. Bush Co., 310 Broad St., Newark, New Jersey.

LATEST "Rogers Side Cars" equipped all colors with extension side on motorcycle, while this low stock held, prepaid first 1,000 miles, \$110. Used and rebuilt motorcycles, side cars, tanks, \$25.00 up; engines, \$15.00 up. Full price tanks, fittings, complete, \$7.00; other fittings, state your requirements. Kansas stamp. Brinkley, 8229 Parrell Avenue, Chicago.

SMITH Wheel Auto, only \$42. Fine condition. V. Tetter, Haddonfield, New Jersey.

MR. ADVERTISER: Ask to-day for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

MANUFACTURING

We do Metal Stamping, Die and Mold Work, Gold, Silver, Nickel, Copper and Brass Plating, also special finishes. We will manufacture your article either on outright time or contract basis. When our time or metal makes it on your job, you are welcome at the bench. Dunning Manufacturing Company, 1775-1777 East 87th Street, Cleveland, Ohio.

TO Order: Any article in metal, models, tools, patterns, engineering, manufacturing, inventions developed (Cleveland Special) and Manufacturing Company, Cleveland, Ohio.

CENTRAL Machine Works, St. Louis, Missouri. Special Machinery Builders manufacturing in any quantity, dies, tools, battery moulds, stampings and parts.

AVIATION

"FORD" motored tractor upland. You can build your own. We tell how to remodel motor and include full size drawings of metal parts and wing curve with our plans and instructions. All for \$2.00. Consultation with aeronautical engineer free to builders. Ready made parts at reasonable prices. Circular on request. Aviation Directory, Lawrence, Kansas.

COMPLETE set of drawings of the Liberty 12 Engine. A United States standardized Aircraft Engine. Giving all views with number of parts, names of parts and weights of parts. Mail \$1.00. Dept. E, Ocean Publishing Company, 55 West 42d Street, New York City.

THE American School of Aviation announces a new correspondence course in Mechanics of Aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 158A, 431 South Dearborn Street, Chicago.

HEATH Airplane Co's Catalog "N" is the most complete booklet ever published on aeronautical needs. 128 illustrations. Get our pamphlet on Ford and Motorcycle engine-driven airplanes, 4c. also glider circular, 4c. We buy and sell all kinds of aeronautical motors. Heath Airplane Co., Chicago.

INVENTORS desiring information write for our Free Illustrated Guide Book and Evidence of Conception Blank. Send model or sketch of invention for our opinion of its patentable nature. Highest references. Prompt service. Reasonable terms. Victor J. Evans & Company, 151 Ninth, Washington, D. C.

AERONAUTICAL engineer. Expert advice, designs, reports, tests. Motors a specialty. Adrish Van Mudding, City College, New York.

BUILD the Simmons Biplane, price list, drawings and building instructions, \$3.00. Particulars free. Simmons & Lawrence, Fairfield, Illinois.

AIRPLANES—1 to 8 passenger, aeronautical motors 30 to 300 HP. Lowest prices. State your needs. Send for lists "P. A." Aero Exchange, 25 Park Row, New York.

TRADE SCHOOLS

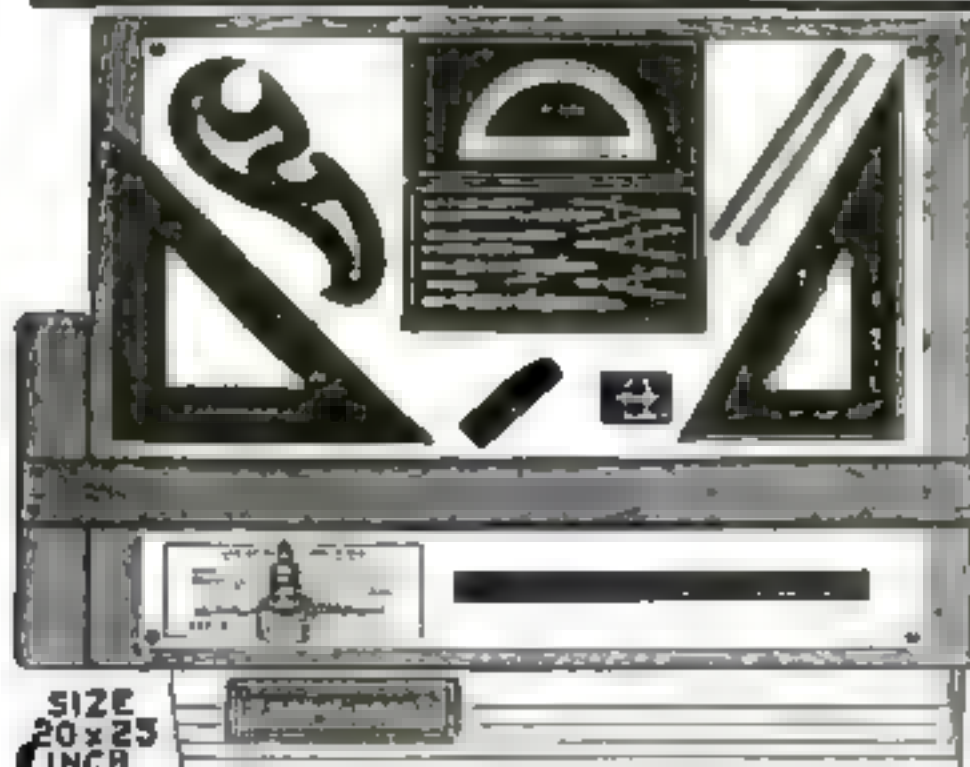
COME to a Real School. Learn Sign, Screen and Logo Painting—Paperhanging—Decorating—Showcard Writing. Catalogue Free. Chicago Painting Schools, 129 North Wells Street, Chicago.

FOR BOYS

SEE page 145. Have you a Saw and a Hammer? **HERE** Buy! Read Nifty Toy Company's ad on page 146.

Drawing Outfit and Drawing Table

FREE



SIZE
20x25
INCH

Complete Set of Drawing Instruments and Drawing Table

Yes, I will give you this complete drawing outfit absolutely free. The instruments are in a handsome high class, plush lined folding case. They are regular draftsman's working instruments. Besides I will give you absolutely free, a 20 x 25 inch drawing board, a 24 inch T square, a 12 inch rule, a supply of drawing paper, two triangles, a French curve, pencils, erasers, thumb tacks, etc.

Delivered at Once

The drawing table is the "Chief's Own" adjustable folding Drawing Table, same as used and needed by first class draftsmen. The complete outfit and table are delivered to you at once. You have them to work with from the very first day.



Be a Draftsman Draw \$250⁰⁰ to \$300⁰⁰ Per Month

There is an urgent demand for skilled draftsmen. Companies are issuing calls every day for men to fill positions paying from \$250.00 to \$300.00 per month. Work is light, pleasant and profitable.

Chief Draftsman Will Instruct You Personally

I am Chief Draftsman of a large and well known firm. I have been doing the highest paying expert drafting work for a quarter of a century and I know just the kind of training that is demanded from men who get the big salaries. I train you by giving you actual, practical work, the kind that

you must be able to do to hold permanent, big paying positions. I give you my individual instruction. If your work is right I will advance you rapidly. If it is wrong I will show you where and make you do it right, and do all I can to make you an expert draftsman and designer in a short time. Write today without fail.

Pay as You Wish

What I want is the right kind of men. Don't bother about expense. I will give you the working outfit free if you get in at once. I charge a very small fee for training you to be an experienced draftsman. You can pay the small cost as suits you best.

Send Coupon for My Big New Book

Put your name and address on the coupon or a letter or a post card and send it to me today. I will send you, absolutely free and post paid, my new book "Successful Draftsmanship," and the great special offer that I am now making on which you get the complete Draftsman's Working Outfit and Drawing Table absolutely free. You accept no obligation of any kind in sending in the coupon. Get in line for a big paying position. Getting the book and full particulars of the special offer is the first step. Don't delay—send the coupon today.

Chief Draftsman Dobe Dept. A-134 4001 Broadway, Chicago, Ill.

Chief Draftsman Dobe

Dept. A-134 4001 Broadway, Chicago

Without any obligations on me whatsoever please mail your book, "Successful Draftsmanship," and full particulars of my liberal "Personal Instruction" offer to a few students. It is understood that I am obligated in no way whatever.

Name

Address



8,320 Burlingtons in the U. S. Navy—

8,320 Burlingtons have been sold to the men aboard the U. S. battleships. Practically every vessel in the U. S. Navy has many Burlington watches aboard. Some have over 100 Burlingtons. The victory of the Burlington among the men in the U. S. Navy is testimony to Burlington superiority. A watch has to be made of sturdy stuff in order to "make good" on a man-of-war. The constant vibration, the extreme heat in the boiler rooms, the cold salt air and the change of climate from the Arctic to the Tropical are the most severe tests on a watch. If a watch will stand up and give active service aboard a man-of-war, it will stand up anywhere.

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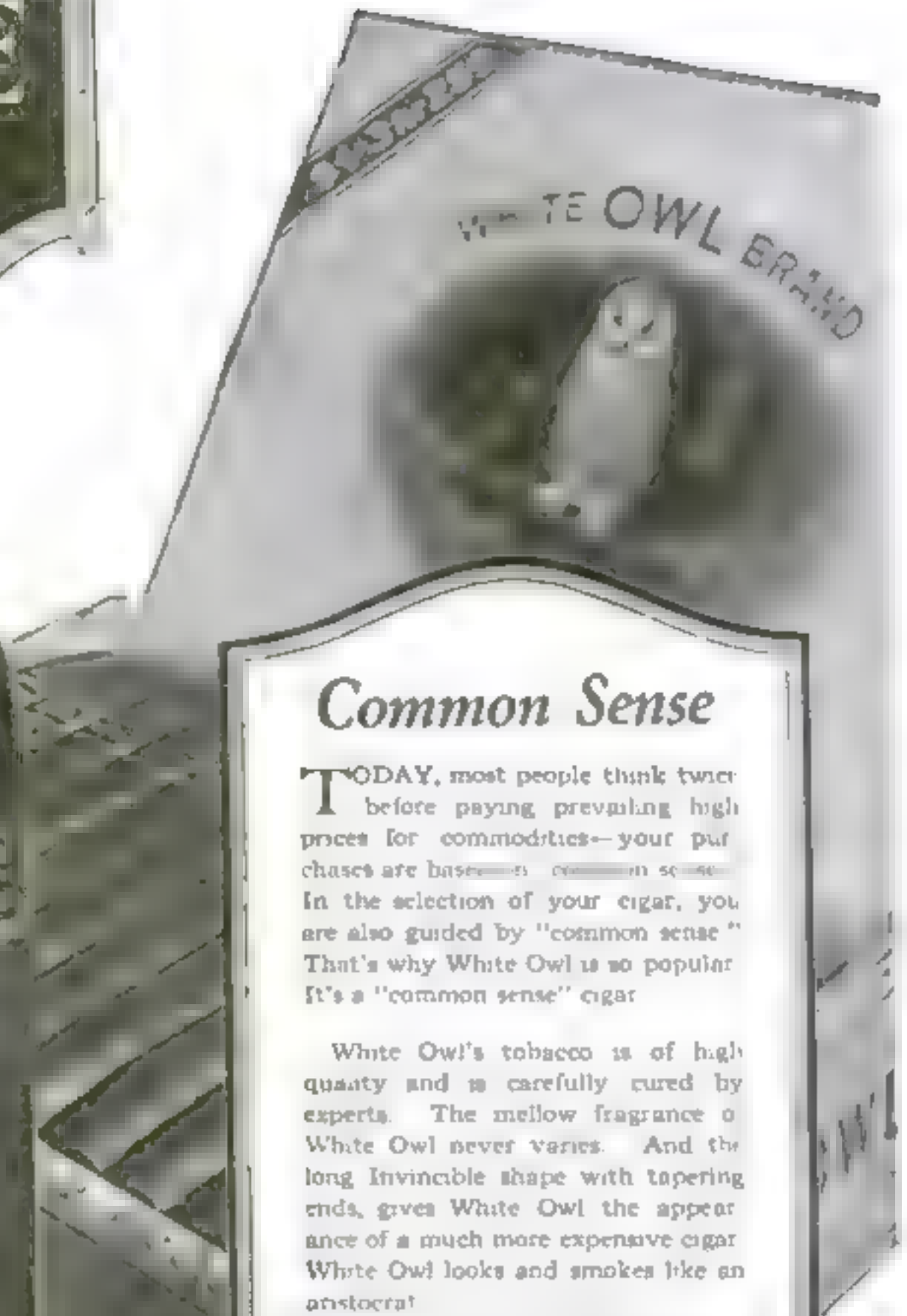
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If the Eye Were a Telescope

We would enter a world of terrifying splendor at sunset

By Latimer J. Wilson

IF the human eye should suddenly acquire the power of a telescope, so that people could see everything magnified hundreds of times, what a strange sunset would end the day! As the dusk turned into the darkness of night, a pale light would flood the cerulean sky, and the most remarkable of sights would be witnessed. Crowds would gather wherever an open view of the horizon could be obtained. Beyond the line of the ocean's rim would come a gigantic disk, so strange and mysterious that at first no one would recognize it as the

Sad and gloomy and eerie, yet majestic in the lights and shadows of weird scenery, is the moon! If people could see the earth's satellite with the naked eye as even a moderately sized telescope shows it, the strange beauty of Astarte would arouse mankind to its highest pitch of excitement. The hill top would swarm with people who had come to witness the

Magnified a hundred or more diameters, the moon would fill the sky with a

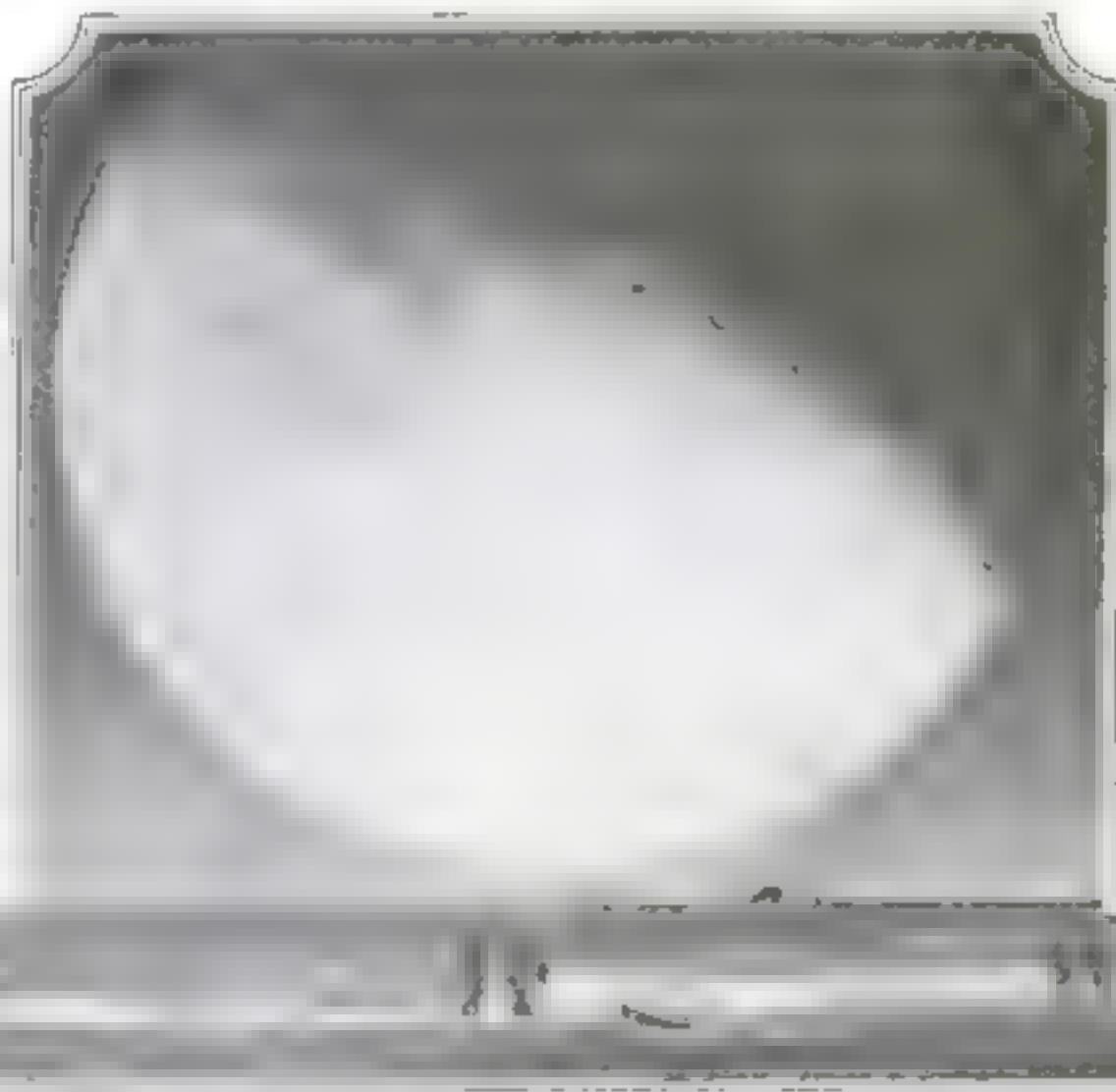
mountain-pinnacles and crater-walls hanging threateningly downward toward the earth. Men would distrust the power of gravity to hold such a mass of heavy material above their heads. The features of the familiar "moon man" would be transformed into arid plains pitted with black holes. Curious serpentine valleys, filled with shadows or brilliantly flashing the fire of sunshine; phantom peaks of mountains protruding from pits of bottomless night; crater-floors marked with fantastic shadows—the

eye as a telescope would disclose all these when we looked at the gibbous or the half or the crescent moon!

One normally thinks of the rising moon as a disk that is much smaller than a man of average height. But if a man should be seen projected against the disk of the moon when he stands a mile from the observer, he would appear only about one tenth of the diameter of the lunar disk, and he would be scarcely visible to the naked eye—unless it possessed the power of a telescope. If he stood closer he would

be proportionately larger, and if he were further away he would be vastly smaller. In proportion to the huge hemisphere of the earth's satellite. To see the wonders of the heavens and to include the familiar features of the landscape, the observer would have to occupy a position that commanded a perfectly clear view. Otherwise near-by objects would intrude their magnified size upon the scene.

Having witnessed the moon rise and pass serenely across the



A strange light appears above the sea. There are silhouettes grotesquely wavering in the flowing currents of magnified air, through which the telescopic vision must penetrate. The light grows brighter and the gigantic disk of the moon appears



Rings of dust and meteorites surround the globe of Saturn. To see them without a telescope would be one of the greatest sights permitted the eye of man.

heavens, the crowds would now behold a spectacle more fantastic than imagination has ever conceived. Every one could now see the splendor of Saturn, the ring-bound planet which before had been visible merely as a point of light shining steadily among the twinkling stars. This most beautiful of worlds comes into the sky in all the majesty of glittering moons and rings, scintillant in the light of the far-away sun. Says Omar

From Earth's Center through the Seventh Gate I rose.

And on the Throne of Saturn sat.

Yet the author of the Rubaiyat never saw the ring of Saturn as the telescope reveals it.

It Vanishes as You Draw Near

At a distance of nearly 800,000,000 miles from the earth, the planet is a conspicuous object softly shining in the darkness of the night. But if one could approach close enough, Saturn would almost vanish, because its surface—so greatly magnified and spread

over so great an area of the sky—would be far less bright to one's eyes than when seen with its light concentrated upon a smaller area.

Saturn's ring is composed of small isolated bodies, each separately too insignificant to be individually seen from the earth. Meteoric dust-clouds, they circle swiftly around the equatorial girth of the planet. The bodies are evidently more scattered in that portion of the ring closest to the ball of Saturn and also in the outer rim of the ring, while a broad black gap occurs within the ring itself in which there are no visible reflecting bodies.

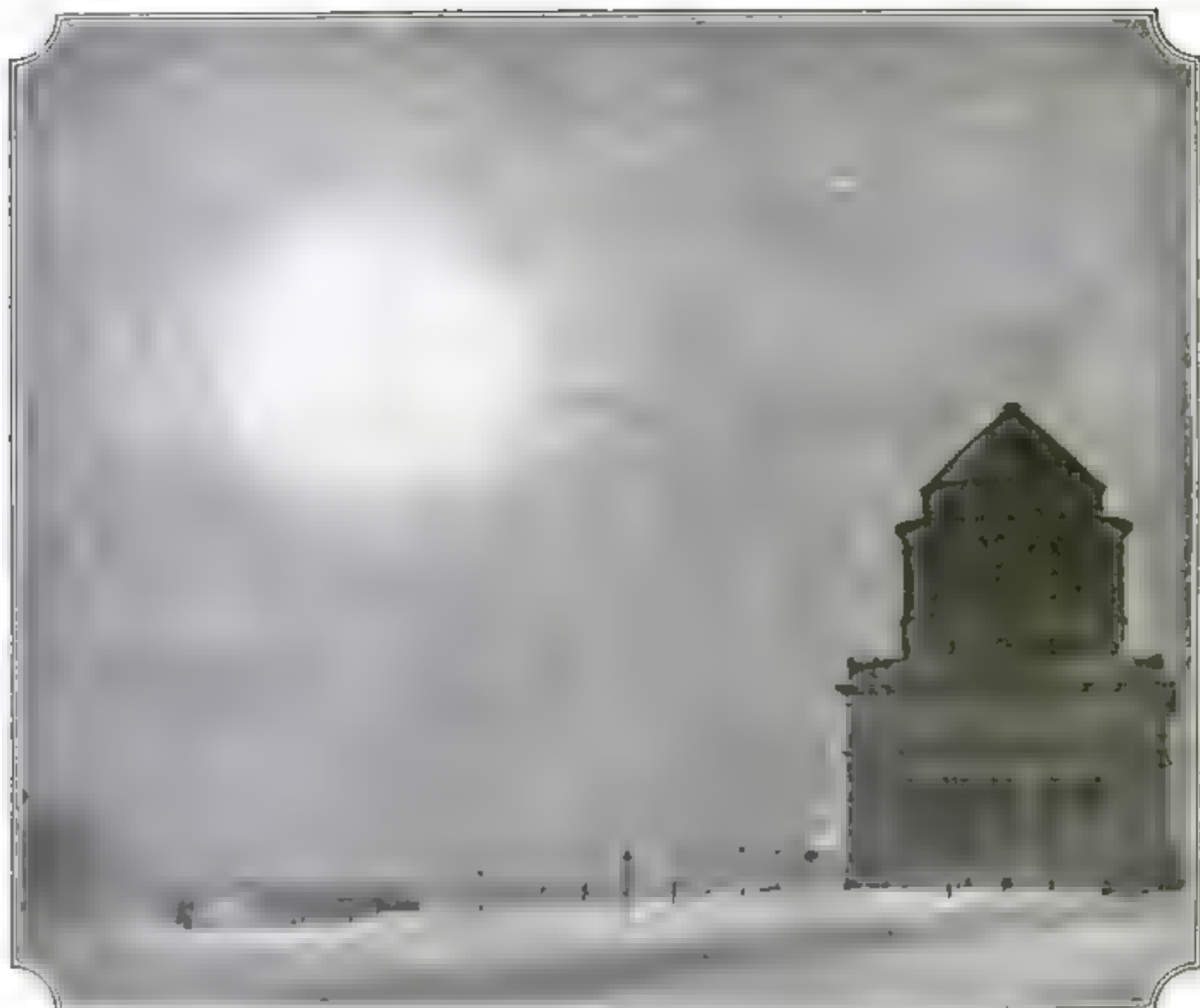
If one could approach very close to the great race-course of the ring, the little masses circling around it would be seen as mere dots of light, and the effect of the beautiful ring would utterly be spoiled. There are evidently vast clouds of tenuous dust, scarcely as dense as the haze of spring, which sweep back and forth across the rings as the forces of gravity and light-pressure operate. The moons of Saturn cause "tides" in

the ring particles and dust-clouds, producing what might be called gravitational waves, grinding together the denser masses, and passing in undulating motion throughout the plane of the ring.

Stars that Swarm by Thousands

In certain parts of the heavens can be seen on a dark, clear night a mere hazy patch of luminosity, too faint to attract attention. If the eye were a telescope a marvelous transformation would occur when the observer glanced at one of these spots. Instead of the insignificant wisp of light, scarcely visible, would be seen a magnificent globular cluster of stars!

Hidden in the vast distance of space, these curious balls of suns are to be found. Literally thousands of stars are congregated in these mysterious swarms, and many of the individual members are variable in their light. They become alternately bright or faint in the course of only a few hours, flashing like lazy fireflies.



The magnificent cluster of stars in Hercules, which appears merely as a speck of light, but which to the eye of telescopic power would resemble a bursting rocket. Suns of many colors are in this swarm.

in a summer night. If the eye possessed the power to disclose these amazingly beautiful objects, and people could see them associated with the landscape near the horizon, men would crowd every hill to witness the scene. A count of the exceedingly faint members of the sun-swarm might raise the total number in some of these clusters to 50,000 stars, the brightest streaming from the center in curious spiral arms. It is estimated that the light of one of these clusters is at least 37,000 years, traveling 186,000 miles a second, on its way earthward.

Like Rockets Bursting in Air

Magnified a hundred or more times, the globular cluster becomes a truly impressive spectacle. Associated with the familiar landmarks on the distant horizon, and magnified many times, the great star-ball, which actually occupies an area in the sky scarcely one sixteenth the apparent space occupied by the full moon, would drop below the horizon like the myriad

sparks from a huge bursting rocket, astounding the spectators by its magnificence. "Can that mere speck of wispy light be that which I now behold?" would ask the spectator, comparing this telescopic object with its normal naked-eye view.

Turning toward another point of the horizon, a ball of light, a bright disk three or five times larger than the normal apparent size of the familiar fair lunar orb, could be seen. Shining like a star of dazzling beauty would be a curious white spot attached to the edge of the disk. It is the distinguishing feature of the most talked of planet, the earth's older neighbor in space, Mars. The white spot marks the polar snow of the planet.

With the passage of time men would become so accustomed to what the telescopic power of their vision disclosed that they would no doubt cease to marvel at what they saw. The magnified grandeur of the universe would become commonplace, but there would remain a wide and undiminished interest in the ever-changing phe-

nomena of Mars. The snow-caps, melting in the sunshine of the Martian summer or forming in whiteness during the winter, would ever attract attention. The delicate tints flashing like an opal in the sunlight, the sweep of seasons showing across the vast gap of millions of miles, would always make Mars a subject for newspaper publicity.

Enjoying the Martian Scenery

If, without a telescope, observers could look at Mars and see its yellow deserts, its areas of blue-green forests and fields, its drifting clouds, and its regions of frost, if they could watch the strange shapes of the planet's markings as rotation brings them across the disk, the spectators would find such fascination in the views that people would speculate upon how to discover a means of finding out what manner of life prevailed there. The growth and decay of the remarkable streaks called "canals," thought to be projects of engineering skill producing an abun-

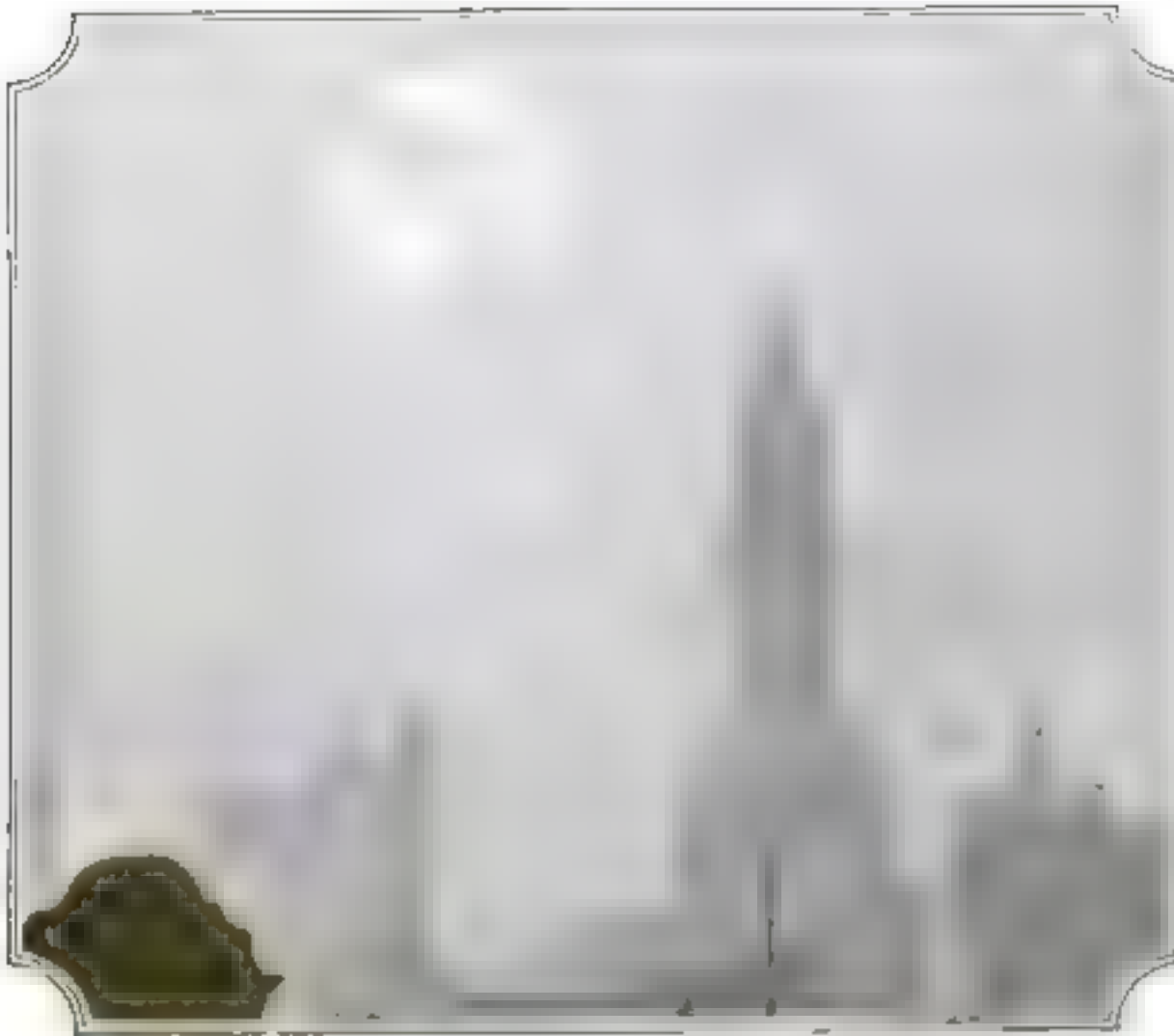
dance of vegetation by irrigating the desert regions of Mars, would be a fertile subject for newspaper controversy.

Bridges of Flame at Sunset

How strange would be the sunset! The enlarged sun, extended over a greater portion of the sky, would be less bright, area for area, than when concentrated in a smaller disk. But one would still have to use a shade-glass to look directly at it. Sun-spots, which are sometimes visible to the unaided eye, now could be seen as great fantastic shapes of darkness strung across the sun's bright disk.

Legend gives the buffalo's eye the power of magnification. But if the human eye took on the power of even a small telescope, to include landmarks, such as the Brooklyn Bridge, in the field of view, the observer would have to stand many miles away. Otherwise the bridge itself would eclipse the setting sun.

Man would view the sun, the moon, the star-clusters, and the planets magnified one hundred, four hundred, or one thousand times their naked-eye size. A new heaven and a new earth would be created for human sight.



From three to five times larger than the normal disk of the full moon, Mars, with its gleaming snow caps, would be astounding if we could see it like this with the naked eye

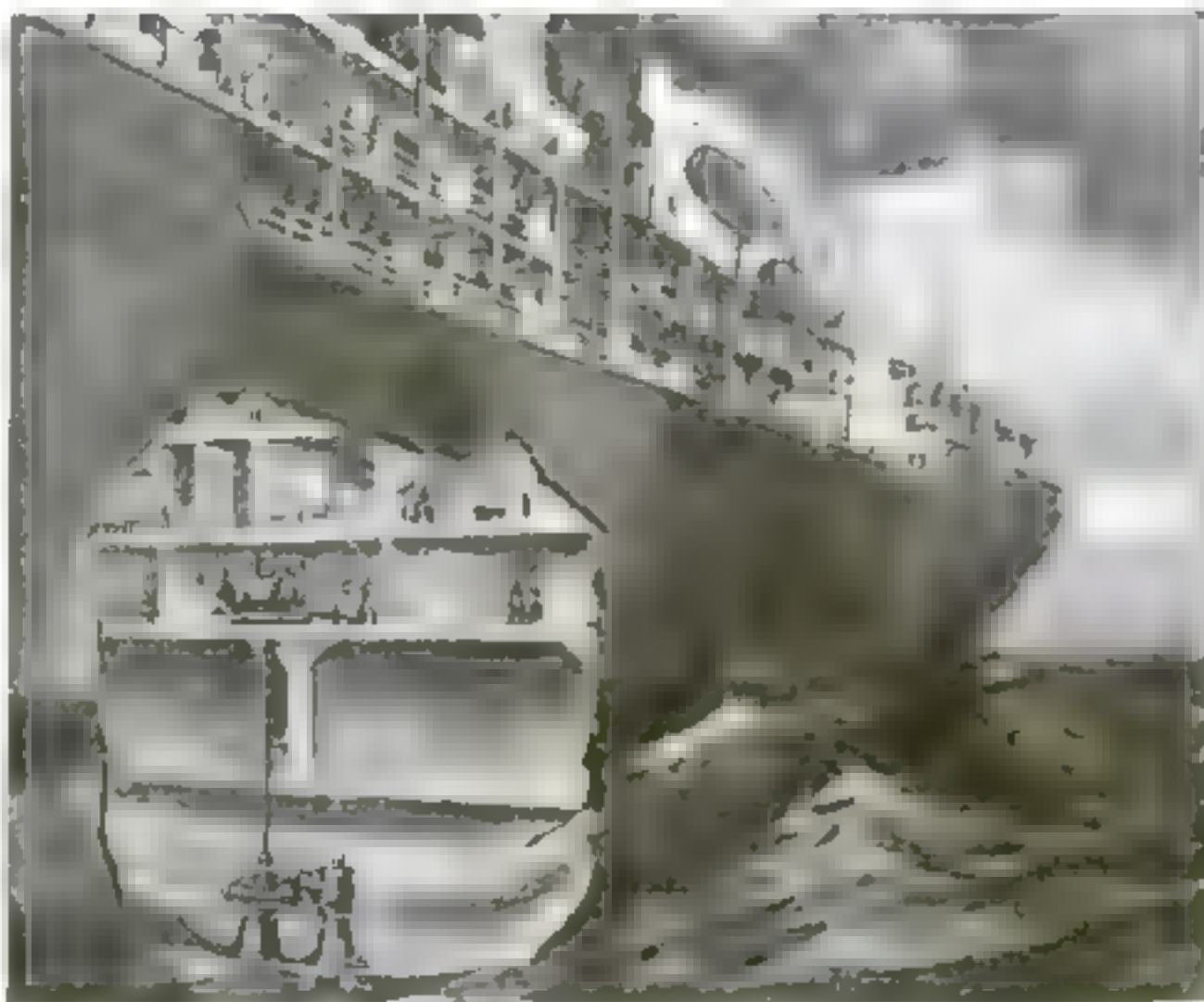


How the eye of telescopic power would see the gigantic sun. It would be too dazzling to view without a shade-glass. The observer's distance from the bridge would make it small enough to be included in the scene

Submerge the Pump and Save the Sinking Ship

A SUDDEN violent shock causes the ship to tremble. Soon the pumps of the great liner are set to work, trying to pump out the water from the ship's hold faster than it pours in through the rent in the vessel's side. Which will win?

If turbine-driven bilge-pumps have been installed throughout the vessel, there is a good chance that the rush of water pouring in will soon be outdone by the work of the pumps. Then repairmen will patch up the ship at least



Water can't drown out this pump, which working while submerged, gives a new chance to ships with sides rent by collision at sea

sufficiently to make port.

The pump consists of a turbine driving system, power for which is furnished by gasoline, steam, or electricity, the turbine being operated above the submerged compartments while the pump itself is submerged. The water passes through openings near the base of the pump, and swiftly revolving vanes create a vacant space, into which the water rushes, to be expelled by the centrifugal force and sent through an outlet in the ship's bottom

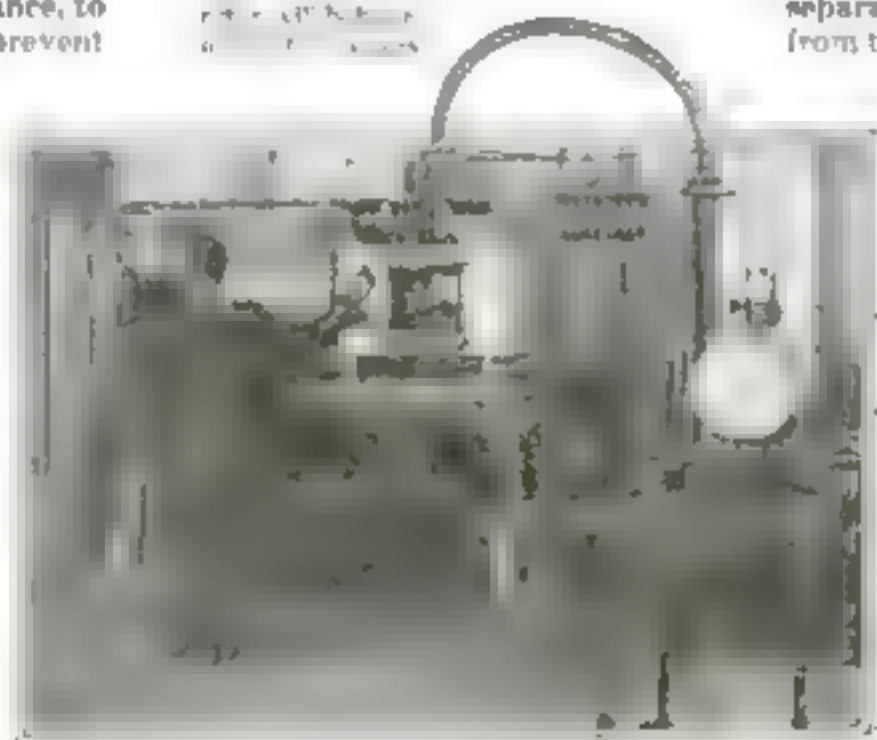
"Reaching the Ceiling" on the Ground

WHEN an airplane has reached the highest altitude that is possible for it, it is said, in aviators' parlance, to have "hit the ceiling." To prevent airplane engines from balking at the conditions usually encountered high in the air, the Bureau of Standards has developed a remarkable testing apparatus. In the laboratory are artificially created "altitude" conditions, so the carburetor of the airplane engine can be properly given rigorous trials.

The decline, in the course of recent years, in the quality of gasoline has thrown a constantly increasing strain upon the carburetor of the gas engine. An automobile taken from sea-level to work upon a high mountain is likely to develop curious ailments unless forethought has provided a carburetor that will function as well eight or ten thousand feet above sea-level as it will in the lowlands.

When airplanes fly into the region of thin air, the engine acts somewhat as does the human heart when it is suddenly carried into a reduced density of atmosphere: it thumps violently against the lessened resistance. There-

Discovering in the laboratory how a carburetor will function at high altitudes



fore, in the case of the engine as well as in that of the heart, strict attention must be given in advance to make sure that it is strong enough to adapt itself to the change.

The Bureau of Standards has created all of the conditions that the carburetor is likely to meet in passing from dense air at sea-level into the thin

atmosphere above the six-mile altitude. To avoid the complication of separating the carburetor troubles from those of the rest of the engine, the

tests are arranged for the complete isolation of the carburetor. It really is the equivalent of taking this part of the engine upon a fanciful trip where all the conditions of the upper levels are encountered.

The carburetor is mounted in a small chamber where it is possible to alter the atmospheric pressure at will. Air can be drawn out with vacuum pumps until only a quarter of the normal pressure prevails, and it can be increased to a far greater pressure. In this altitude chamber the duties of all kinds of work, under every conceivable condition, can be

imposed upon the carburetor and its performance observed.

An engine must stand the severe conditions due to the rapid change from lower to higher altitudes. The engine is the airplane's heart, throbbing violently when conditions are abnormal. Laboratory tests will enable the mechanical "heart" to stand the strain.

Good Roads at a Mile a Week

AN enterprising contractor decided that, instead of building cement roads at the rate of one mile a month, he would build them at the rate of one mile a week. To do this he maintained a "material-yard" in which the road-making material was arranged systematically. Then he built a track along which strings of cars carrying large "batch-boxes" could be drawn from the yard to the cement-mixer.

A locomotive crane handled the material, and the box train was pulled to and from the paving scene, a progressive transportation of the material taking place. The huge boxes, each having a capacity of 55 cubic feet, first were loaded with the necessary amount of stone. Then they passed on to the cement hopper, where the re-

quired amount of cement was admitted through a metal cylinder holding 5 cubic feet, and so arranged that it could be filled and emptied until enough cement had been added. After this the cars were shunted to the sand-hopper and the proper proportion of sand added to the stone and cement. The train of fifteen cars was then sent out to the concrete-mixer.

Wheels four feet high with a 20-inch tread enabled the gigantic concrete-mixer to be moved from place to place as the work advanced. The mixer stood 16 feet high, and a 35-horsepower engine furnished the power to mix 28 cubic feet of concrete to each batch of the aggregate, weighing more than two tons.



One of the great "batch boxes," which can be easily lifted from the car-bed to empty its load of aggregate into the mixer to be made into concrete.

One of the locomotive cranes dumping a "batch box" into the mixer. It is the use of these great boxes, weighing more than two tons each, that made the speed of a mile a week in road building a reality.



Killing Weeds by Steam

IF the anti-tobaccoists don't put one over on us some fine day in the near future, then the new tobacco-seed-bed sterilizing process will come into its own. Heretofore the seed-beds have been freed from weeds and undesirable growths by fire. Large quantities of brush were

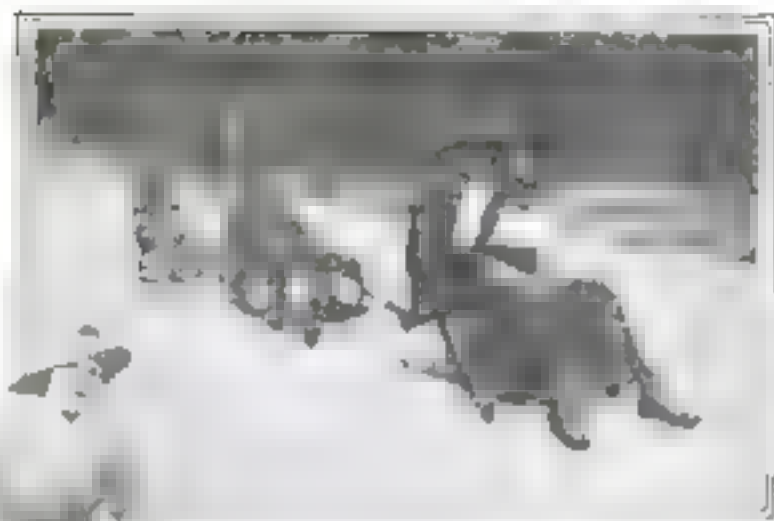
burned on them. But in the new method sterilization is accomplished by steam.

A large pan about four inches deep, having a steam-boller connected with it, is necessary. The pan is turned upside down and sunk into the bed. Then the steam is turned on. A boiler that will furnish a supply of 25 horsepower should be used in connection with a pan that measures six by twelve feet. A smaller boiler necessitates a smaller pan. The pan may be made of wood, but the joints should be smeared with white lead to prevent the possible escape of steam.

The sterilization of one thousand square feet of plant bed will cost approximately six dollars, since half a ton of soft coal will do the job.



Tobacco seed beds are now sterilized by steam: a steam boiler and a shallow pan, inverted, will do the job.



Coasting on the Summer-Winter Sled

DRESSED in a straw hat, a long veil, a moody blouse, a long skirt, and a pair of flat-heeled slippers, a Viennese maiden takes out her sled. Why the summer outfit? The answer is simple: it is summer.

Her sled—as you will see if you study the picture on the left—is equipped with three rubber-tired wheels that enable her to slide down hills with it in summertime as well as in the winter. Of course, when there's snow on the ground she takes the wheels off.

She steers the sled by means of reins that turn the axle on which the front wheel is mounted. The rubber tires make riding easy—except when one of them gets punctured.

© From Illustration on page 20.

Though it is summer in Vienna, the people go sledding down the hilly streets; their sleds have wheels attached underneath.

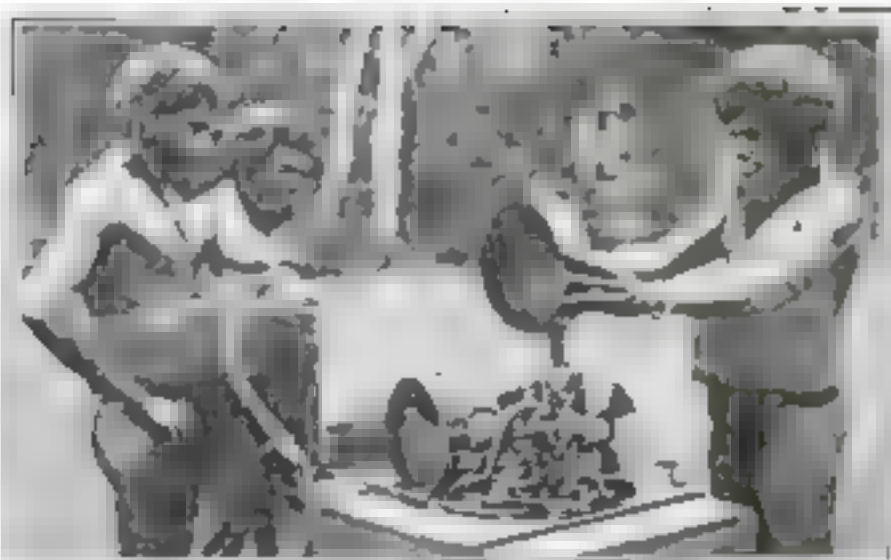
Safety First for Experimenters in Kite-Flying

POWERFUL forces are hidden in the invisible realm of the atmosphere, which occasionally make themselves known in a highly dangerous manner. When Benjamin Franklin made his wonderful discovery, using a metal key and a kite-string to bring the electricity from the sky, the wonder is that he was not electrocuted in the daring attempt.

A wet kite-string is a good conductor, making the static discharge between cloud and ground easy. Experimenters flying kites with metal "strings" stand a far greater chance of bringing down the lightning, even when no cloud is in sight. Last August a man was killed when standing near a kite-string of wire while a kite was being reeled in. He held a piece of wire in his hand at the time. A series of bright sparks suddenly ran up the string, and the whole length of the kite wire, more than a mile, was instantly fused. A scar was burned on the victim's chest, and there was a severe burn on the inside of his wrist.

While these accidents are rare, the fact that they do occur should warn kite-fliers of the possible danger. But during the period of about twenty-five years in which the Weather Bureau has engaged in kite-flying this is the first accident of its kind that has occurred.

A dark cloud does not have to be in sight to warn the men who make use of metal kite-strings. Static electricity is always present, and if the kite is sufficiently high to act as a conductor, then look out for the flash.



Natives of Malekula Island examining a motion picture machine. They attributed the projected pictures of themselves to magic.

As Cannibals See Themselves

TWO years ago Mr. and Mrs. Martin Johnson risked their lives on Malekula Island taking motion pictures of the savages. They were captured by the vicious chief Nagapata, and had to run for their lives, just managing to effect an escape. But later these intrepid explorers made another trip to the island, and this time they were

received like royalty. What brought about the change of heart of the cannibal king? Mr. Johnson took with him a generator to furnish the light for a motion-picture projection machine. He hung up a screen between the palm trees, and in the starlit night of the southern seas he exhibited, under the protection of an armed guard, motion pictures of the natives themselves. So amazed were they at seeing their past actions thus preserved that they immediately set the whole thing down as a work of "devil magic" too astonishing to be combated. Therefore they figuratively handed over the keys of the island to the white explorers, and the chief personally led them about from tribe to tribe, openly boasting that he had brought them there.

Gliding Down a Thousand Feet

IT was a curious airplane that started downward on a thousand-foot drop. There was no one in it to steer it to safety, yet it landed gracefully.

"But what about the danger to people on the ground when an airplane comes unguided to land? Haven't pedestrians any rights at all?"

There is no danger when the airplane is only a model not large enough to carry a pilot.

In a contest of flying models held recently in the city of Los Angeles a strange type of flier was taken up to an altitude of about one thousand feet and released. A crowd watched it from below, and the model was seen to spin around for a moment, caught in the "wash" of the propellers of the big machine. Then it became stable and gracefully began its long glide of more than a mile. With the greatest interest the crowd watched it through glasses until it drew close enough to be observed with the naked eye. A while later a great shout greeted the strange little airplane's perfect landing.

This biplane model differs in one important particular from ordinary airplanes, the invention of this type being accredited to

Mr. Edwin G. Getuna. In the ordinary biplane the wings are open at the ends and ailerons are relied upon to furnish stability. In the new model the frame at the end of the planes is arranged somewhat in the form of a truss.

The planes are closed at the ends by the crossing of the top and bottom plane, the top plane bending downward and the bottom plane bending upward.

Tipped one way or another by the sudden onslaught of a current, the flow of the air is controlled by the lines of the crossed section and the plane is stabilized.

The model of a new type of airplane is here seen rising rapidly against the wind. It will be noticed that the tips of the planes are bent in a peculiar way that gives stability to the model.



How the Worm Gets in the Hazelnut

WHERE did the worm in the hazelnut come from? That question has puzzled many a boy. He knows that the nuts he gathered were carefully culled and that none were stored that gave any evidence of being unsound. And yet, a few months later, when he begins to crack the nuts, he finds that a surprisingly large number are wormy.

Where did the little fat white worm come from?

The worm is the larva of a strange-looking insect known as the hazelnut weevil, an insect that belongs to the same family as the much-dreaded boll-weevil, which is periodically so destructive to the farmer's grain.

As will be seen in the illustration, the insect is provided with a long, slender proboscis, or snout, at the extremity of which is seen a peculiar hooklike appendage. The proboscis is a modification of the mouth parts, and but for this snout the worm would never find its way into the nut.

In the late summer, while the nut is still green and tender, the mother weevil goes in search of a place to lay her egg. The egg must be kept safe from harm during its incubating period, and when the larva hatches, it is highly important, from the weevil's point of view, that there be food close at hand so that the baby weevil will not die a prematurely early death.

Instinct has taught the mother weevil that no better place could be found for her egg than the inside of a hazelnut, for there lies safety for her egg and food for her offspring. So the mother weevil begins to peck away with her queer-looking snout, and in due time she has made a tiny tunnel to the center of the nut. Then she lays an egg, poking it well down into the tunnel with her snout.

In a short time nature closes the opening and the egg lies safely within, finally hatching into a little white grub. The grub finds food aplenty and grows fat and rotund.

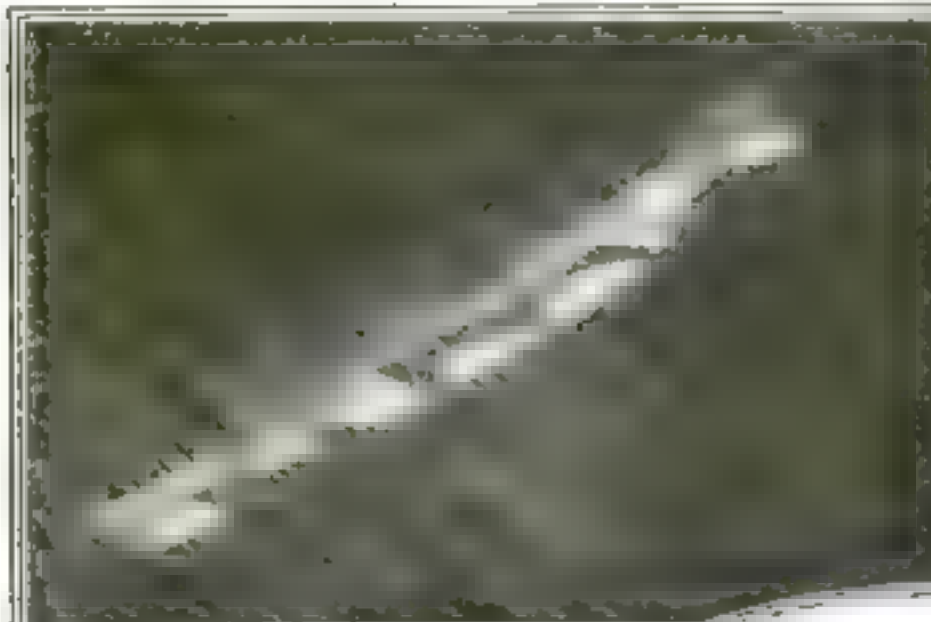
When the food is all gone and he is full grown, the baby weevil gnaws his way out of the hazelnut that has sheltered him and is ready for the second step in his development, that all-important step which will transform him into a weevil exactly like his mother.



Mother weevil pecks at a green hazelnut and deposits her egg in the center when it comes to life it ruins the nut.

Peace-Time Jobs for Aerial Photography

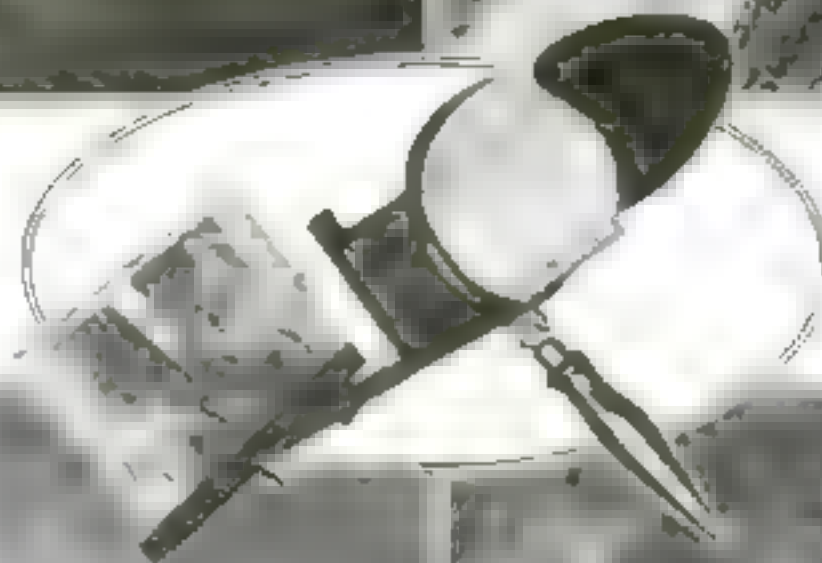
Photographs by courtesy of Dr. Herbert E. Jones from *Airplane Photography* J. B. Lippincott Company



That white streak on the water in the shadow cast by a wrecked aircraft is at least twelve fathoms deep. During the war airplanes were used for locating submarines; now they are used for locating sunken ships.



Did you realize that a single airplane can search through the water for much more than a submarine? The airplane can see the surface of the water, and the submarine can only see the surface of the water.



In taking pictures from a high altitude a haze layer is often encountered. This part of the picture is an air field of 1,000 feet with no haze—the haze blotted out the territory.



The space between the two pictures is the haze layer. The haze is a layer of air that is 1,000 feet thick and blots out the territory below it.



If you can't afford a trip to Venice—the "Bride of the Adriatic"—at least you can attend a lecture on it. Travelogue lecturers are now exhibiting aerial photographs like this one of the Rialto bridge.



These pictures are designed for use in a stereoscope (see the one pictured above).



The explorer, the geologist, the geographer, and the map-maker will find airplane views of the greatest help. The whole town of Bengazi, North Africa, is clearly shown in this picture, taken by an Italian aviator.

Where There's a Thirst There's a Way

Photographs © Kadel & Berbert

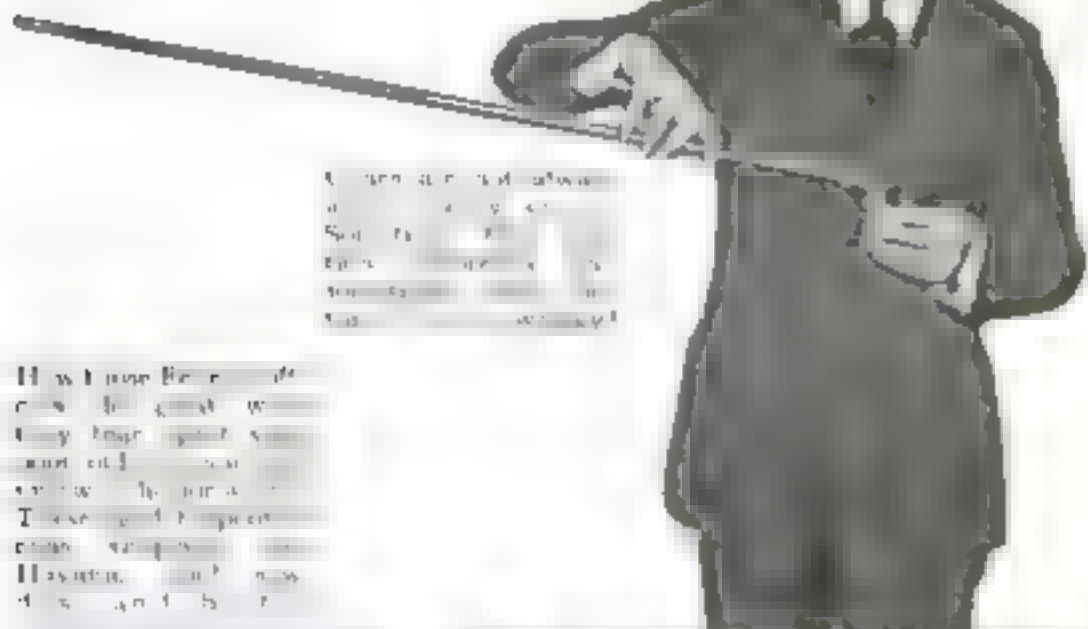


He got in by ap-
proaching the
border. By passing
through the customs
and paying the
proper duties
he was able to
enter the country.

The customs and
taxes are not
paid for the
goods that are
brought in. That
is why a way for a
good smuggler is
to take some
bottles and other things



He just to keep it
in his pocket. Now he
pays it out a little
for. Does it really
take to be a smuggler
why he wants that?



A man in a suit and
tie is shown from the
chest up, looking down
at a small object he is
holding in his hands.
The background is dark
and indistinct.

How many people
are there in the
country? They have
not yet been counted.
There are many
people who are
not counted. They
are not counted.
They are not counted.



Formerly he filled his
pocket with free
liquor. Now it is
valuable liquid.
What would occur
if he should happen
to have a blow-out
just as he crossed
the Canadian border
on his way into our
dry country?





Out of the flaming electric arc there came a human voice; there was part of a broken sentence, then the flame snapped out and the voice with it

A Voice Spoke from the Storm

But the startled hearer found a scientific explanation of his uncanny experience

A VOICE out of the night and the storm

The voice fell on ears that knew there could be no one to utter the call. It was a voice apart from all human relationship. The hearer confesses that his flesh seemed to creep and thrill.

And yet, it was the day of the material present and not the eerie time of ghost and goblin. The place was East Lansing, Michigan, and not the domain of witches.

It is Professor Herman Vedder, of the engineering department of Michi-

gan Agricultural College, who relates the experience. Those who remember their Jules Verne will remember the thrill with which they read of the message that came over the telegraph line to which it was supposed no one could have access except its makers. Professor Vedder's experience was like that, only the chance of human agency seemed even more remote.

The circumstance was related by the professor to a group that had remained following a meeting of the Lansing Engineers' Club at the college, and was discussing some phases of a

lecture that had just been delivered on advanced theories of electrical science. The group had been chatting informally, and the conversation led up to the experience told by Professor Vedder. Someone had just said that the physical seemed to taper off into the super-physical.

The circumstance in question occurred back in the days when wireless telegraphy was under the close observation of students and investigators, before antennae were strung from the house-tops of experimentally inclined boys. Professor Vedder was a student of the new wonder.

On the night in question Professor Vedder was sitting over his instruments, in a crashing thunderstorm. How wireless would act, with the heavens surcharged to the limit with electricity, was the matter under observation. Presently, however, prudence dictated withdrawal.

"I drew back hurriedly from my apparatus," said the Professor. "A flash of lightning ripped into my station, and across one of my instruments there blazed a flaming electric arc. Out of the flame came a human voice—I heard part of a broken sentence. It lasted for an instant. Then the blaze snapped out and the voice ceased."

It was some time afterward that the explanation was worked out. You perhaps know that an arc light responds to the resonant effect of the human voice. What is known as the 'singing arc' is well known to physicists. That is, a telephone circuit is introduced into a current supplying an arc light, and out of the arc word vibrations can be made to come.

"Now, on the occasion of which I speak, a sudden flash of lightning had formed an arc across part of my apparatus. This circumstance befell just at the time the telephone wire leading from the home of one of the other professors had been blown by the storm across my wireless aerial. The voice was that of the professor's wife, who was attempting to telephone the grocer. Later she told me what she had said, and the words I had heard fitted in with her sentence. But the first unexplained effect was most uncanny."

Nature Presents Her Gas Bill

And it's a big one because we must pay for tremendous waste

By Calvin Frazer

EVERY year the American people pay out millions of dollars for the natural gas they don't get.

When a town in the gas belt is forced to turn from natural to artificial gas because the local supply of the former is exhausted, the citizens of that town are put to heavy expense in reconstructing the heating and lighting arrangements of their homes, stores, and factories. This happens, on an average, in fifteen American towns each year. Incidentally, an added strain is placed upon the nation's coal supply, and we all pay a little more a ton for coal. When a number of steel plants and glass works are forced to turn from natural gas to coal, we all pay a little more for steel and glass. In such ways nature is presenting her belated bill for a commodity that we once thought was as free as air and water. We are paying for the gas we don't get, and, to make matters more exasperating, we are paying for billions and billions of cubic feet of this precious fuel that we never did get, because it was deliberately thrown away after being brought out of the earth.

A long time has passed since we learned by bitter experience that the supply of natural gas is really limited; yet the colossal waste still goes on. According to estimates recently prepared by the Fuel Administration, the amount of natural gas wasted in the United States in the year 1917 was equivalent to \$1,200,000,000 worth of artificial city gas.

How Gas Is Wasted

Here are a few of the many ways in which natural gas is wasted.

Gas is always found at oil-wells, and only a small percentage of this gas is ever turned to account. It is a common practice of oil operators to blow off the gas in order to procure the oil. Many fine gas-fields have been depleted by this process. It is stated that the oil-wells of West Virginia alone are thus wasting annually at least seventy billion cubic feet of natural gas, equivalent to about one third of all the natural gas used for domestic consumption in the United States. At both oil and gas-wells gas is wasted through improper casing of the bore-hole, improper plugging of abandoned wells, and in various other ways.

Natural gas that is captured and piped to the consumer is very profitable to the best advantage. Under



© Anthony Hercules Powder Co.

The gas well was on fire! A flame by day and night, visible many miles away. It leaped 200 feet in the air, permitting 190,000,000 cubic feet of gas each day to be consumed

stress of competition the gas-fields are over-produced, and the underground pressure of the gas is soon disastrously lowered, often resulting in the invasion of the wells by water. The old practice of selling natural gas at a flat rate of so much to the consumer, or at so much to a fire or other fixture—no meter being installed—survives in many places, thus putting a premium on waste. "Boom" towns still lure the manufacturer by offering gas for nothing, or at a ridiculously low rate. Wasteful open-flame torches, or blow-burners, are still found in the gas belt.

There are two salient features of the situation that seem not to have been generally realized until recently. One is that natural gas ought not



The same gas well fire as it looked at night. Great fires like this can be extinguished only by dynamite exploded in the air at the side of the flame

to be used for industrial purposes at all. It is an ideal fuel for the household, and, where the domestic consumer might enjoy an ample supply at a very low cost for gas, if the gas were allocated to household use, the demand of factories soon result in the decline and failure of even the richest gas-fields, so that both householder and manufacturer are driven to using a far more expensive and less convenient fuel. The other important lesson to be drawn from the history of this industry is one directly opposed to the existing attitude of the government toward unity of action among the operators. Competition leads to stupendous waste. Pooling of operations should be not only permitted, but encouraged or made obligatory.

A Source of Gasoline

Natural gas is a blessing that brightens as it takes its flight. To-day, when all the world is clamoring for gasoline, we know that our rapidly-waning store of natural gas is one of the readiest sources of this substance. Nearly all natural gas contains gasoline vapor. The gas that issues from oil-wells, known as "wet" or "casing-head" gas, contains upward of three fourths of a gallon of gasoline to each 1,000 cubic feet of gas. The natural gas obtained from gas-wells is rela-

tively "dry" or lean in gasoline vapor; yet it carries enough of this ingredient to cause serious trouble along the pipe-lines, in which the condensed gasoline decomposes the rubber couplings.

Unappreciated Gasoline

A few years ago the gasoline in natural gas was looked upon as a nuisance. Today it supplies about one tenth of all the gasoline used in this country. Natural-gas gasoline is highly volatile, and is used for mixing with petroleum distillates too heavy to be sold alone as gasoline. The original methods of extracting gasoline from natural gas—by compression and condensation—were applicable only to low gas. Within the last three or four years, however, a new process whereby the gas may also be treated has been introduced with great success. In this process the gasoline vapor is first absorbed from the gas by means of oil, and then the oil is treated.

The latest episode in the story of natural gas came to light just after the Great War, when it was learned that methods had been developed for extracting helium from natural gas of low heating value found chiefly in Kansas and

Some burning gas wells can be controlled by placing a hood over the flame.



Here a gas well is controlled by placing a hood over the flame.

It was proposed to use the helium, which is non-inflammable and non-explosive, as a substitute for hydrogen in flying balloons and airships. The abrupt ending of hostilities delayed the execution of this plan, but possible commercial uses of helium are under consideration, including its substitution for nitrogen in filling incandescent lamps.

Value of Helium

Every day brings attention to the increasing value of the natural gas that men formerly permitted to go to waste. If all the value that was then turned out into the air could be corralled and brought back to the service of industry, the coffers of the world would be considerably richer thereby. If all of our army balloons during the war had been inflated with helium, a product of natural gas, there would have been greater safety. A dirigible filled with hydrogen, or one of the immense Zeppelins inflated with the inflammable gas, is a menace unless special precautions are taken to ground it properly and prevent a static discharge from setting it afire. Many a balloon has blown up when coming in contact with a minor object that could conduct the current of electricity, but with helium there is no danger from this source.



Getting the hood in position. Cables are swung for a trolley, and the great metal hood is pulled directly over the flame; then it is released.



The amount of gas that goes away to the service lines that heated the houses is almost lost to gas which by products are consumed. This is the quantity and other useful substances are secured from a gas that in former days was allowed to escape and be lost.

Showing the relative amount of natural gas that is used for domestic and for industrial purposes.

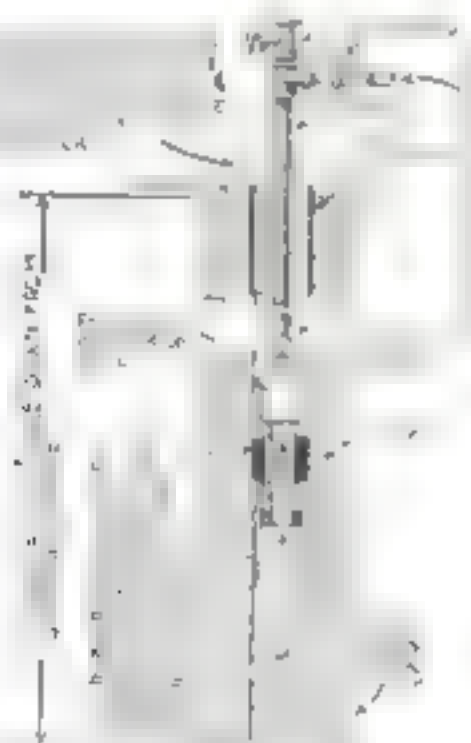
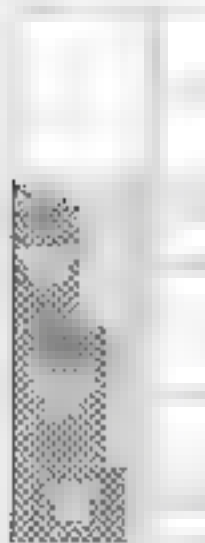
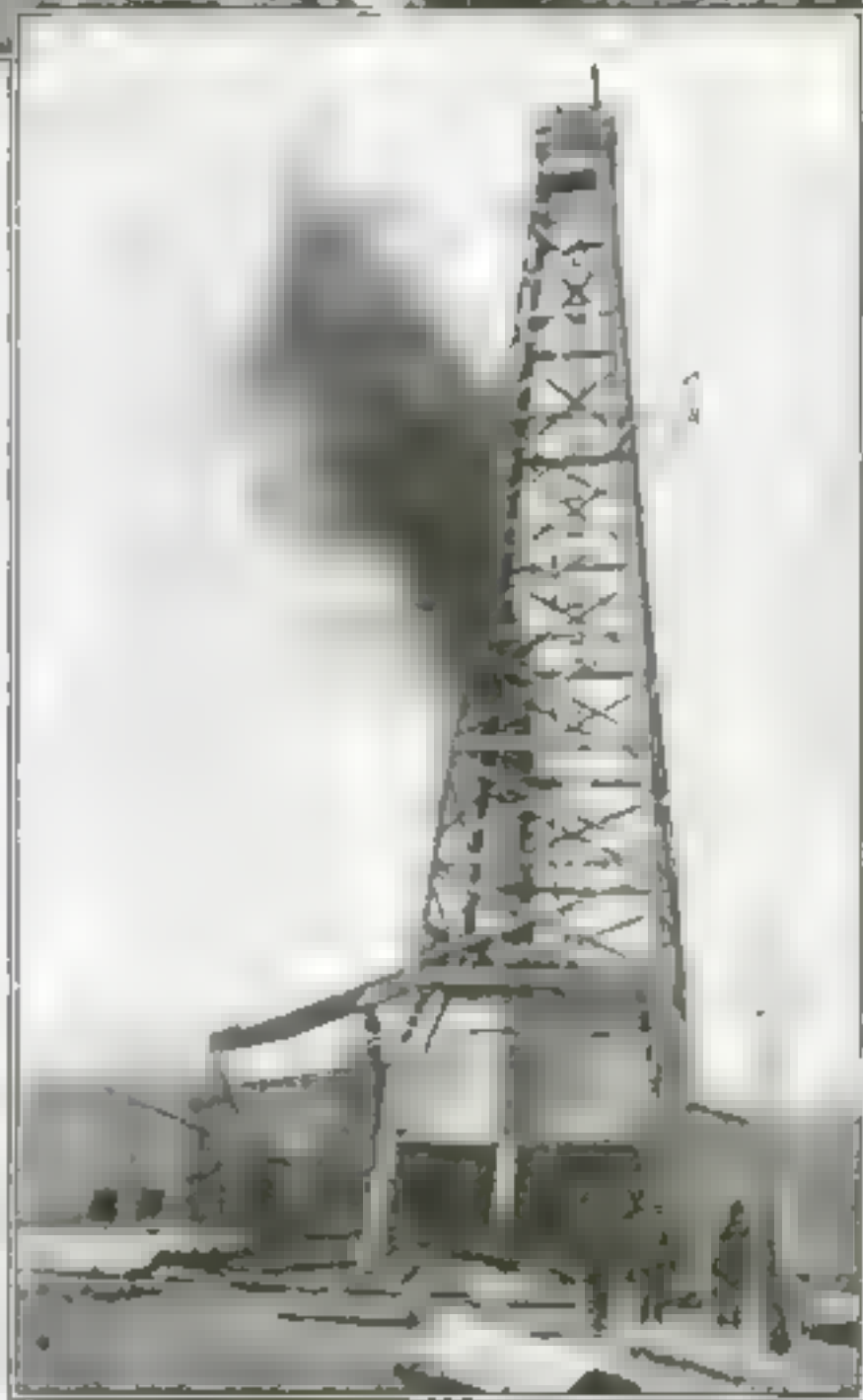
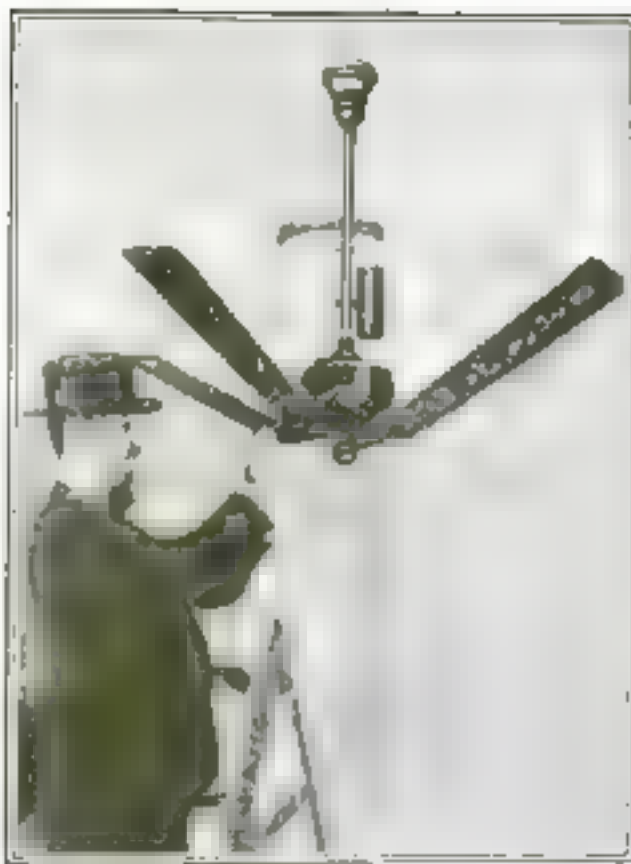


Diagram of a gas well. A gas well is a hole in the ground through which gas is brought up. The gas is brought up by a pump or by a gas lift. The gas is then used for heating or for industrial purposes.

Shooting an oil well opens the way for a great blow off of sand and natural gas. The friction of the sand against the iron pipe often causes spalling and these sometimes set fire to the gas.





By using an adjustable hinge, the ceiling fan may be induced to do double work

A Folding Fan Increases Air Currents

"**PUT** a hinge on the ceiling fan, partly fold back the blades, and the air will be distributed over a greater area of the room. But this is not all: you can fold the blades entirely up and put a bag over them!"

This is what the man who has a folding ceiling fan has to say about it.

The hinge may be attached to any fan after the blades have been sawed off. Then anybody can make the adjustments by merely loosening three thumb-screws.

Partly folded upward, the blades, when they are revolved, will cut the air in such a manner as to throw the currents outward and downward over a wider area of space than usual.

In winter-time, when the fan is no longer needed, the blades may be folded upward, and a bag, kept in the small tube in the fan stem, may be taken out and adjusted around the blades, thus protecting them during the idle months.

Mr. A. W. Tucker, chief engineer of the Hotel Tulsa, in the city of Tulsa, Okla., is the inventor of this very ingenious device.

Get Your Own Goat

WHERE would I keep her? That's what you say when some anti-food-trust enthusiast suggests that you get a milk goat. Mr. J. Brown, of Evanston, Ill., suggests that you keep her in your back yard. He has invented a goat stall that is easily and cheaply built and takes up little space.

It is made of wooden beams, covered with canvas that rolls up conveniently. The floor is made of concrete and is easily cleaned. A bucket for the goat's food hangs from the top beam. The whole stall is hardly any larger than the goat herself. Thus, in cold and stormy weather it can be moved to the cellar.

A good goat will cost about thirty-five dollars and will eat food that a cow would spurn, yet she will produce better and more nutritious milk than a cow. A goat produces twelve times her weight in milk in one milking period, a cow only four times her weight.



Goats are cheap and the milk good. Why not keep one in your back yard?

Sailors on the Half-Shell

WHENEVER United States battleships set out for maneuvers the sailors rejoice. They like the excitement and the sport of mimic warfare. Below you see some of them playing "oyster" on the deck of one of the battleships. They are all on half-shells.

These half-shells are parts of mines. During the maneuvers mines are laid, guns fired at targets, and submarines attacked. One of the targets is in the picture.



These sailors on the half-shell are ready to take part in a mimic warfare; the shells they are sitting on are parts of mines



This little llama was born knock-kneed; but his keeper is correcting the defect

Trials of a Knock-Kneed Young Llama

KNOCK-KNEED llamas are just as unattractive as knock-kneed men, and in both cases the defect should be remedied when they are young.

One baby llama that lives in the Cincinnati Zoo was born with these ingrowing knees, and his keeper strapped them up in a pair of iron braces. At first the baby objected; he refused to walk or even stand up when they were on. But his grouch gained him naught, and in a little while he was frisking about with the rest of his family. Every day his keeper drew the straps a little tighter, and in five months his legs were perfectly straight.

When he grows old enough to care about his good looks he will undoubtedly be thankful for this deed of his keeper.

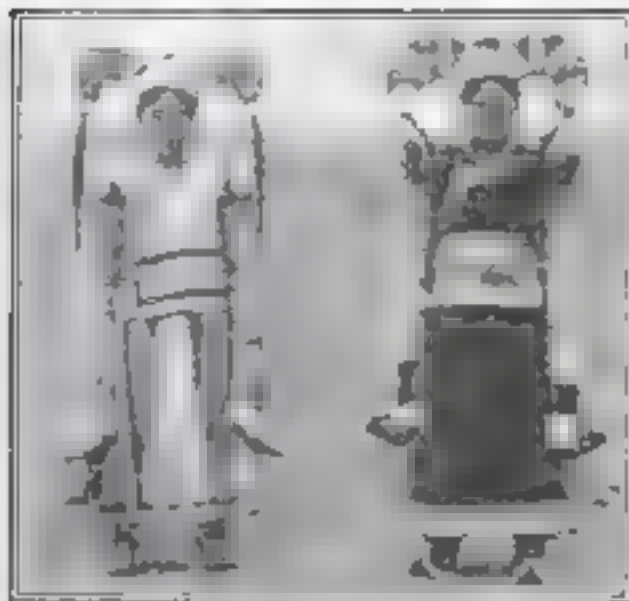
In the Age of Machinery!

AROUND and around in the same old circle goes Mr. W. W. Figue, of Prandio, Tex. He is harnessed to a bar that turns a capstan. And thus he works an irrigating-pump connected with a reservoir on his ranch.

This primitive method of operating a pump is very laborious and seems unnecessary in this great age of machinery. But perhaps there is no large source of power near Mr. Figue's ranch—which, by the way, is located very near the Mexican border.



By tramping around and around he operates an irrigating-pump on his Texas ranch



Hats and sleeves indicate wealth in Mongolia; small fortunes are spent on them

By Their Hats Ye Shall Know Them

WOMEN'S hats have often aided in man's financial downfall, but the man from Mongolia suffers most. He saves money all his life with but one object in view—to buy his wife a hat that will be more elaborate than that of the wife of his neighbor. Even a poor man will spend at least two hundred dollars on a hat and a pair of sleeves to go with it. Hats and sleeves are indications of wealth in Mongolia.

What strange hats and sleeves they are! The sleeves are twice as long as they need to be and have ugly puffs at the shoulders. And the hats—a milliner would call them toques with horns standing out on each side. Braided hair switches are tacked on.

Lunch, Twenty Cents

CONGRESS is still working on the problem of the cost of living, but a Washington man is solving it.

In a sanitary paper box he puts up a "Liberty lunch" consisting of two sandwiches, a piece of cake, and an apple or an orange, and sells them at twenty cents a lunch. He packs the lunches in wooden chests and sells them on the street.

At first the chests were placed on the edge of the sidewalk, and the lunch sold from it. But local restaurant men called attention to a city regulation that prohibits the use of the streets for business purposes, and the twenty-cent lunch was seriously threatened. Then the restaurant man discovered that there is another city regulation that allows the sale of articles from moving carts; so he put wheels on the chests and continued business.



Putting a lunch chest on wheels also put it within the law

The "Movies" Ancestor

THE desire to produce pictures in motion was partly satisfied in ancient Java long before the dream of Edison was realized. But these forefathers of the "movies" were crude affairs compared with the simplest of modern motion-pictures. A feature of the ancient movies was the telling of the story in spoken words.

From a sheet of deer-skin clever artists cut figures to illustrate the story. The curious figures are held so their shadows are cast upon the screen, and moved about animatedly.



Shadow pictures presented to the United States Museum by the King of Siam



Although he has embraced a new faith, the Maori still keeps his totem-pole

A Double-Decker Airplane

DOUBLE-DECKER airplanes have recently made their bow with the appearance of a new Italian triplane.

With four propellers to keep the giant flier in the air, the forty people who are seated comfortably in the double-decked fuselage are safely transported from place to place.

Think of an airplane having two decks! Who can forecast the limit of the number of wings and the number of engines and the number of decks that the future generations will witness in travel by means of airplanes? It staggers the most vivid imagination.

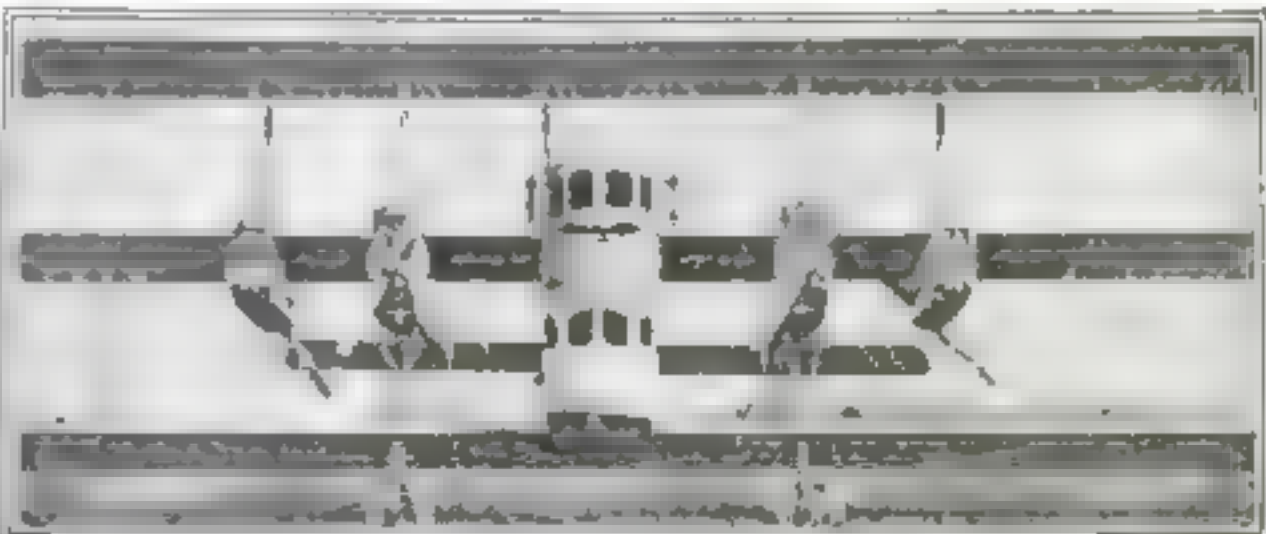
The balance between motive power, weight, and area must, of course, be confined within certain limits. When one looks at the fossil remains of some of the ancient gigantic birds and lizards that had the power of flight, it is not unreasonable to speculate on the possible forms of man-built flying-machines.

In the Land of the Maoris

PRESENT-DAY Maoris are nominally Christians, but there are many old chiefs who are still fond of their ancient totem-poles. Their religion is that of nature-worship combined with the veneration of ancestors. A peculiar and interesting detail of their religion is the belief that the soul dwells in each human being's left eye.

The Maoris were enthusiastic cannibals in by-gone days, their favorite dish being roasted hearts. Eating the hearts of their enemies was supposed to give them strength, especially in the pursuit of war-time activities.

As for the Maoris' marriage laws, they seem to have had none. But they believe very strongly that man should have absolute power over woman. Even today they have very broad views on the subject of matrimony, and each man generally takes unto himself as many wives as he can afford to maintain.



The new Italian triplane carries forty people and is driven by four engines. Its unique feature is a double-decked fuselage

If Your Child Swallows a Safety-Pin

No longer is an operation necessary for the removal of foreign bodies in lungs, esophagus, and stomach

THAT serious situation arising when foreign objects such as beans, corn, nut kernels, nails, tacks, staples, etc., are inhaled into the lungs formerly required extensive and highly dangerous operations or still more dangerous blind efforts at removal. Less than one per cent of such objects are coughed out again, and if the object is allowed to remain, various degrees of lung inflammation result.

Nut kernels, particularly those of the peanut, have been found to cause the most rapid, serious, and sometimes fatal results, when drawn into the lungs by young children. The presence of a peanut in the lungs of a child under one year of age has caused death inside of twenty-four hours.

The older the child, the less severe the reaction. Peanuts or peanut candy should never be given to children before they have teeth to chew them thoroughly.

Metallic objects seem to be less irritating to the lower air passages, but if they are not removed extensive lung changes occur, sometimes simulating tuberculosis with such exactitude that patients with foreign objects in the lung have been treated in sanatoriums for this disease. In fact, it was formerly taught that patients with foreign bodies in the lungs ultimately died from pulmonary tuberculosis. Recent studies have proved this incorrect, for the tubercle bacillus has never been found in these cases, and recovery is

complete when the foreign body is removed.

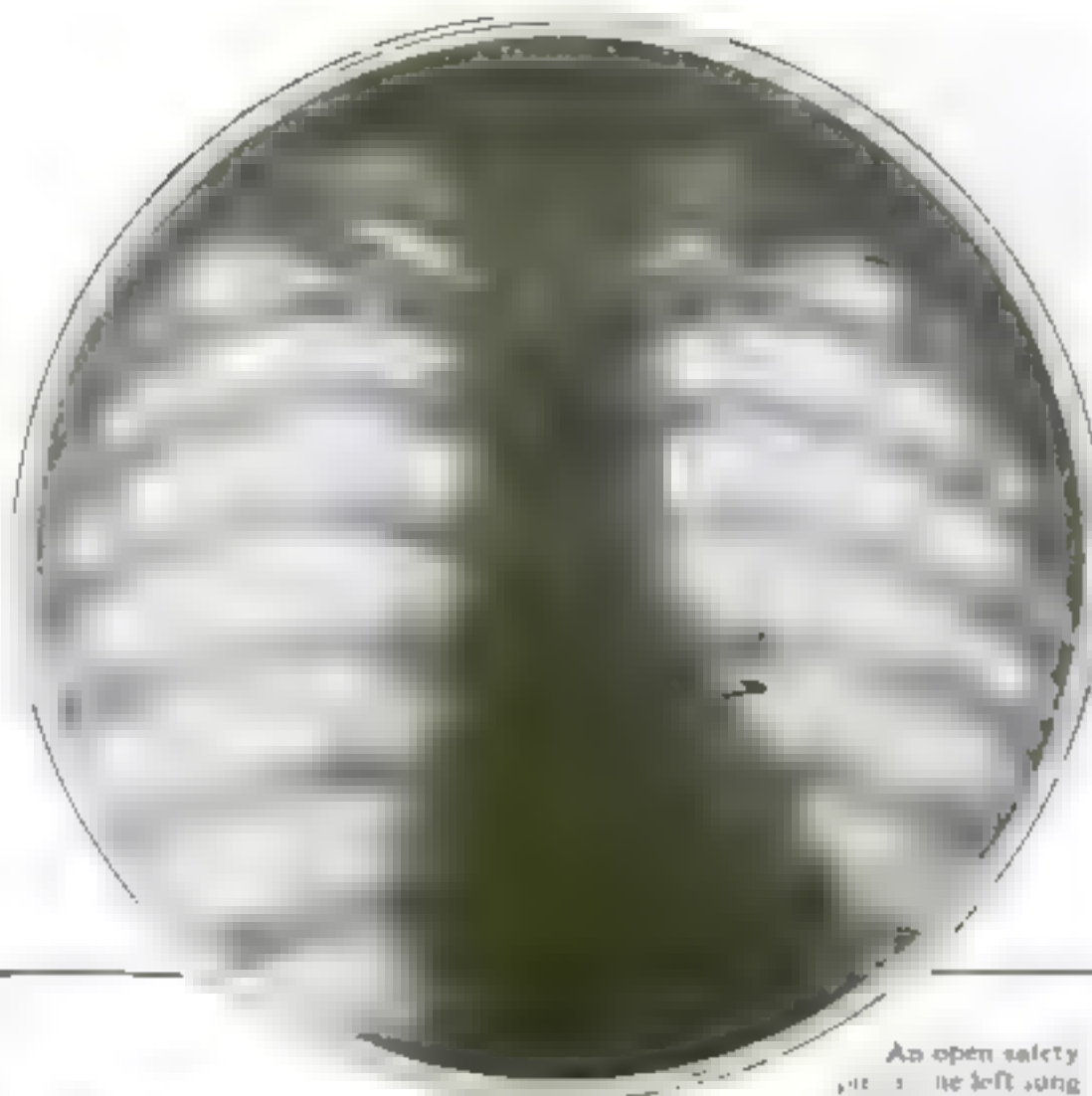
All patients suffering from chest conditions should be studied with the aid of the X-ray, particularly when no tubercle bacilli have been found in the sputum; for in a certain percentage of

these cases a foreign body will be found to be the cause of the trouble. The accident may have happened in early childhood and been forgotten. A collar button is reported to have been removed from the lung after twenty-six years' sojourn, a shawl-pin after twenty-eight years, and an open safety-pin after eighteen years in the lung.

One of the greatest advances in modern surgery is the development of a method by means of which these foreign bodies can be removed from the lungs, the gullet, or the stomach without any cutting whatever. The technic has been elaborated, instruments modified and devised, and the method made practicable by the life-work of an American laryngologist who has removed more foreign bodies than any other person in the world.

In his method a slender hollow brass tube is inserted through the open mouth into the windpipe and down into the lung. The far end of the tube contains an electric light bulb about the size and shape of an oat, which illuminates the interior of the lung, enabling the surgeon to see the obstacle and remove it with long, slender forceps passed through the hollow tube.

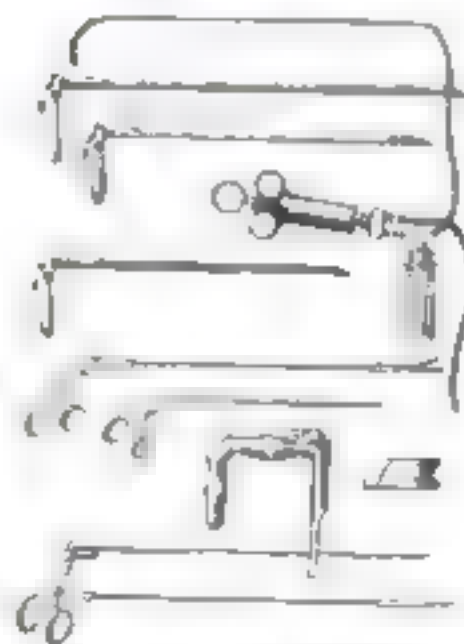
This tube is called a bronchoscope. Similar tubes, used to remove objects from the gullet or esophagus, are called esophagoscopes, while still longer electrically lighted tubes, termed gastroscopes, may be passed through the esophagus into the stomach.



An open safety pin in the left lung no longer is an operation necessary to remove obstacles



Be careful what you put in your mouth. This remarkable collection was made of the foreign bodies removed from the lungs, esophagus, and stomach of a great surgeon's patients



Instruments used for the bloodless removal of foreign bodies from the lungs, esophagus, and stomach. Great skill and dexterity are necessary for this highly specialized work



At the Ford Chemical Laboratory experts study problems of carburetors, gasoline oils, and metals

Working Miracles in Your Own Business

I BELIEVE we need in business and in daily life a better chemical view of things. I don't mean that everybody should be a professional chemist, but rather that everybody should maintain enough of a sense of the subject to have, let us say, a chemical conscience; an occasional appreciation of what might be done, as compared with what is done.

Suppose you and the editor of this magazine and I were three friends going to see a fourth friend who lived in the country, five miles from the station, and that we hired a man with a horse and wagon to carry us out to his house.

Suppose we three were very fond of horses—that we knew how to take care of them and hated to see them abused. Then suppose that the driver had the animal checked up out of all reason, and that he kept yanking the bit and teasing the poor creature and abusing it until it didn't know what to do.

If he let his abuse go too far, I have a distinct idea, knowing the editor, and being alive to my own impatience, and guessing the reader to be another of the same sort, that before we had traveled very far we should make that man behave, and cause him, with the overpowering firmness

Theodore N. Vail says: "Research, investigation, experiment are now necessary to hold any position in any industry"

By Ellwood Hendrick



ELLWOOD
WE once knew a chair manufacturer who could not understand why his chairs fell apart. He bought the best materials. Finally he consulted a chemist, and the chemist reported: "You think you are buying glue. You are actually buying a sort of starch paste which absorbs water from the air. This is why your chairs fall apart."

Theodore N. Vail, distinguished organizer of the telephone system, says: "Research, investigation, experiment comprehensive and

HENDRICK
thorough, are now necessary to hold in position any industry and utility enterprise."

Men have spent huge sums in fitting out expeditions to discover buried treasure. If they would only dig up the treasure that lies buried in their own business!

Mr. Ellwood Hendrick who has done much to drive home the importance of research in industry, tells us here what science can do for any manufacturing enterprise to which it is seriously applied.—EDITOR

power, and coal and iron, and minerals galore; we can grow almost anything that answers the call of the sun; and we want to see our own

American people prosperous as well as good.

We know that, unless the whole world comes to an end, some day we shall be dead and gone, while another generation will live here; and that after it passes away there will be still others in residence; and so on and on and on, as long as there are people.

We do not know those unborn persons, although some of them may be close relatives of ours, and even our own descendants. But just because we don't know them is no reason why we should steal from them.

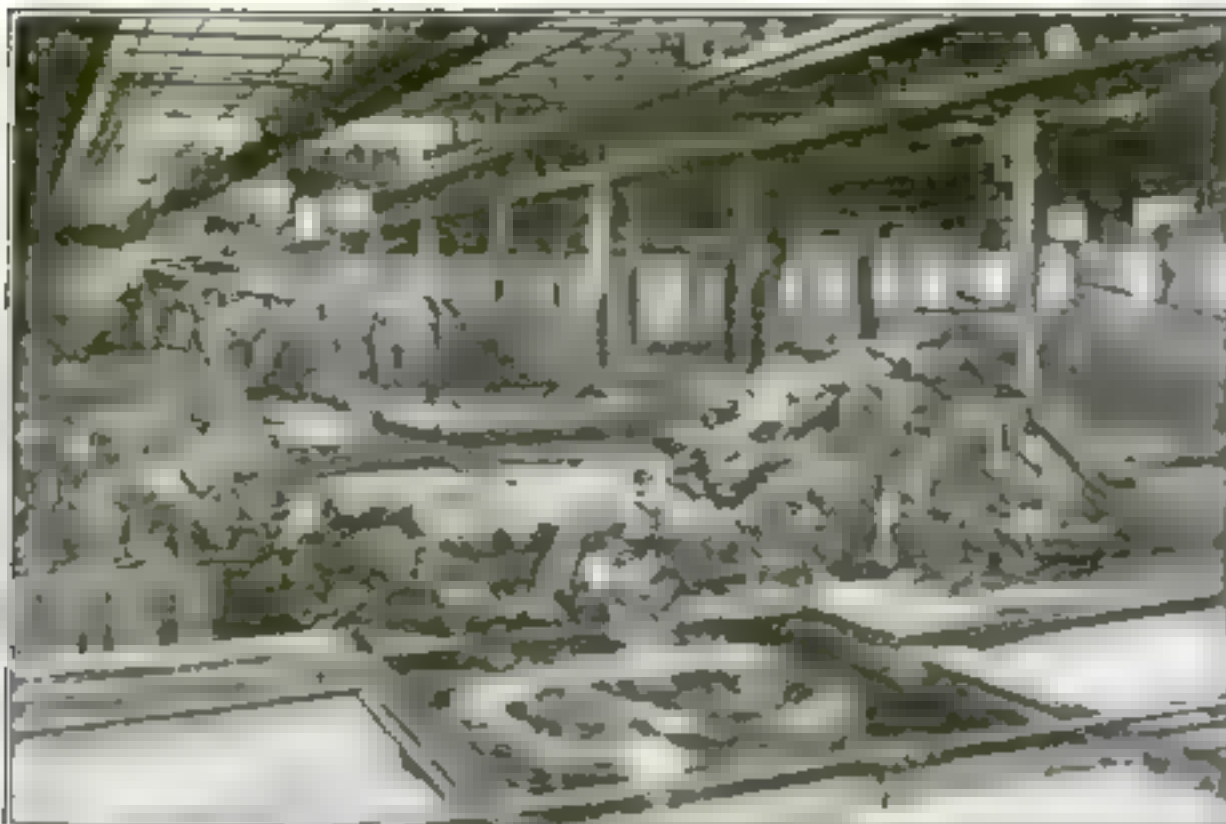
When a burglar sets out to ply his trade he does not, as a rule, know the man whose house he robs. He would, however, have hard work to find a jury that would acquit him on that ground. The law says he mustn't steal from anybody and if we had a chemical conscience we should feel that we mustn't do so

of three husky persons opposed to one, to quit his abuse of the poor beast.

Now, here we live in a country replete with natural wealth. We have good land—splendid land—and water

either, whether the anybodies in question have been born yet, or will not be born for a hundred years.

Whenever we waste coal or oil or natural gas or any of our mineral wealth, we are doing that very thing.



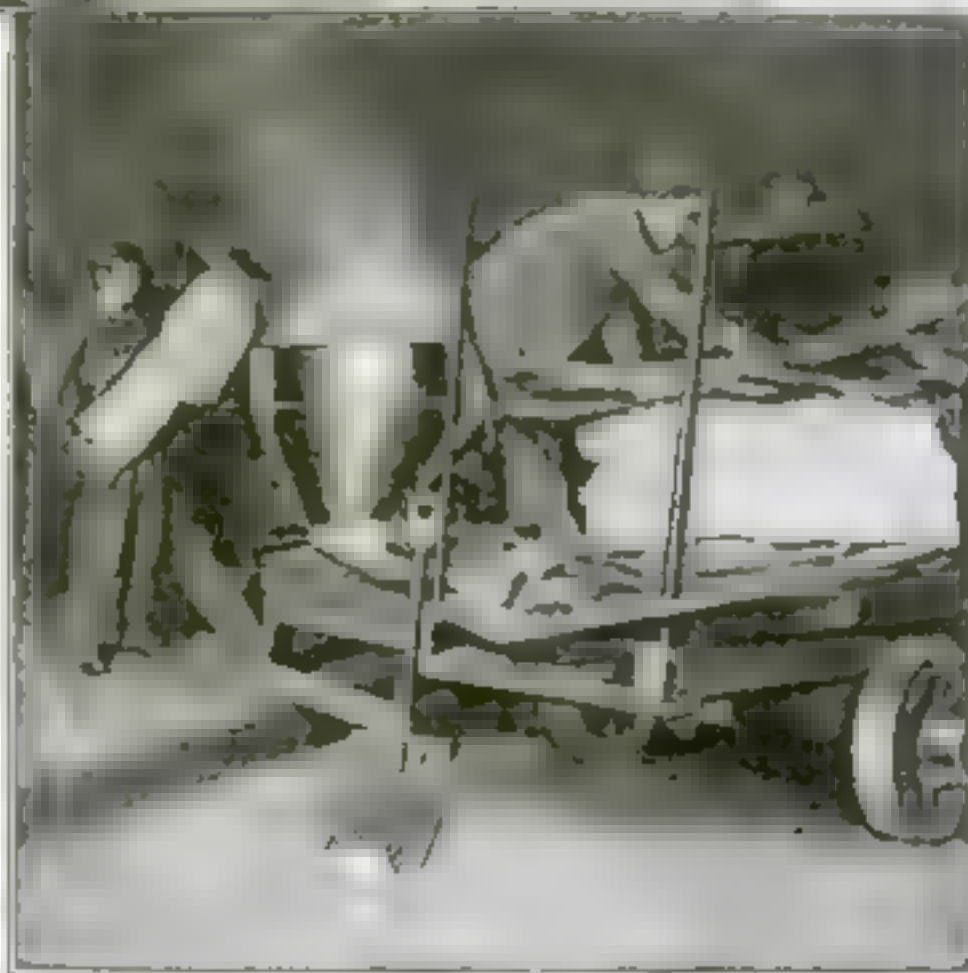
Here sole leather is made from hides placed in the tanning vats shown in the foreground. Before being tanned the hides are placed in a weak solution of lime, then they are subjected to a "dressing" process. The finished leather is then cut into the shape of the sole.

So if we had enough chemical sense—not stowed away in some corner of our minds and forgotten, but alive in our consciousness—we should frequently feel it looking at every-day things, very much as would the three of us in the wagon of that unscrupulous man who abuses his horse.

The Chemical Engine

Let us look at a big high-pressure steam engine and at a big gas engine.

magnificent in its power, and this we admire, just as we naturally admire bigness and strength in almost anything. But it is propelled by expanding steam, and every puff from its cylinders wastes a lot of power and blows out great quantities of producer gas and particles of coal, all of which would be valuable as fuel. The old engine is an outrageous wastrel, and just because we do not know how to make better machines is no reason why it should not be improved. If we only appreciated the real fact that every bit of coal wasted increases the cost of living, the improved and more economical engines would soon be forthcoming. Necessity is the mother of invention, and when enough people tell somebody who is wasting coal that he should stop wasting it, he is likely to find some way to do so.



© Keystone View Co.

The tanning industry demands the utmost of chemistry. The barks that yield tannin are ground into a coarse powder and subjected to processes of disintegration. The outer layers of the bark contain the bulk of the tannin.

It is the business of science to do the impossible. When we get to the point where we are bound to admit that a thing that should be done can't be done with the means at hand, then is the time to call in the aid of the man of science. Let us review, first, a few industries that have been saved or helped by this means, and then point out a few more where the man of science is needed.

The smelting industries of the Western States were in sore distress. Fumes and dust were spread about the country where they were located, until the farmers appeared with injunctions, which are weapons more effective than pitchforks. To the men of sluggish

mind there was nothing to do but to engage lawyers to contest the injunctions; but that did not change conditions. Finally somebody who knew his business discovered the patent applications of Dr. Frederick G. Cottrell, a junior professor of physical chemistry at the University of California, and observed that he claimed, by means of electric currents of very light voltage, to precipitate particles in suspension in the air. He was induced to engage in research to meet this problem, and soon the smelter fumes and dust were precipitated, the air was cleared, and the worst troubles

The Paper Need

By grinding wood into a fine powder under water mechanical pulp was made, and the cheapest, poorest kind of paper was manufactured from it. It had neither strength nor lasting qualities, because the cellulose is so mixed with impurities that it oxidizes and turns into dust. Good paper was made from cotton and linen rags, but there weren't rags enough to go around. In the need, a Philadelphia chemist named Tighman discovered that sulphurous acid dissolves the encrusting substances from the cellulose in wood fiber, thus producing sulphite pulp, from which fine papers are now made.

Iron blast-furnaces were known to turn out more iron in winter than in summer, but the fact was attributed to the inability of men to work as well in hot weather as in cold. Good old ironmasters and sons of ironmasters knew this as the first principle of their trade. But in time they began to think of chemistry in smelting iron, and then men knew that there must be another cause, and that this must reside within the furnace rather than in the men outside it. So James Gayley, an American chemist and engineer, bore in mind the simple fact that the maximum humidity of warm air is greater than that of cold air. In other words, warm air can carry more water suspended in it than cold air can. Let's imagine a cubic mile of air at 95° F., and charged with 100 per cent humidity—that is, carrying as vapor all the water that it can. Then let's cool it down to the freezing-point, to 32° F., allowing

the air to carry all the water in suspension that it is possible to carry at the freezing temperature. How much water do you think would be forced out of that cubic mile of air by the sudden shift in temperature from 9.5° to 32° ? Only a trifling matter of 141,000 tons, or about 35,000,000 gallons!

Inventions Come with Need

Gayley knew this, and he realized how much heat was wasted in driving off the water that was blown into the blast-furnaces in the summer-time. So he proceeded to refrigerate the air before it was used—to cool it with an ice-machine to get the water out of it. This expedient did exactly what Mr. Gayley expected it would do, and saved from one to two dollars a ton on the cost of iron made from that time forth.

These inventions come along about the time when people begin to worry and fret about the cost of things. It is very seldom that they come like a great gift out of a clear sky. They come when they are wanted and needed, and everybody says so; when not only one man but a great many men are anxiously looking for them.

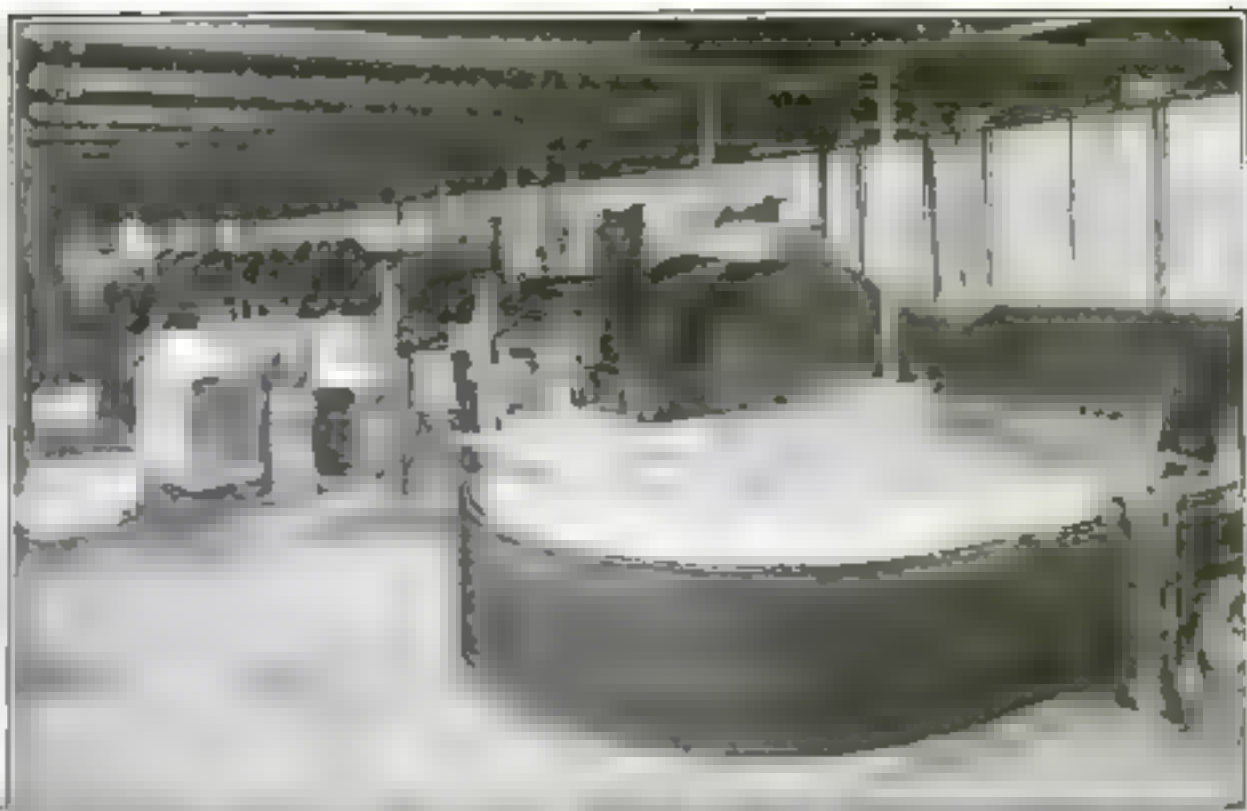
Thomas A. Edison says that 98 per cent of his so-called genius is perspiration and not more than 2 per cent is inspiration.



Now for a few things that should be done, but are not being done: a few places where the man of science is needed.

Speaking of the waste of burning coal in furnaces and under boilers, why do we not burn powdered coal blown in with compressed air, as they do in cement-mills? By this means practically complete combustion is obtained. The trouble is, the heat is too great, and it warps the boiler-plates. It needs to be diffused. In other words, we get, at a greatly reduced rate, too much of a good thing.

The Great Necessity

All that is needed is the diffusion of heat, so as to spread it over a greater surface and to take care of the ash better. Of course, it can't be invented by somebody who thinks he sees a light when he thinks of a fire-brick; but somebody with an understanding of physics and a flair for refractories will invent it some day, and then we shall not be bothered with stokers afloat and ashore, and we shall



The  hides, now made into sheets of leather must be oiled to prevent cracking. The "blubber" oil or other substance  in oiling the leather is manipulated in a great drum

save coal, which is so necessary as to constitute a virtue.

It was, as I recall it, about 1911 or 1912 that Dr. Arthur D. Little and his staff made an investigation of the long-leaf pine industry of this country. These figures have been printed many times, but they will bear repeating. One third of the wood cut is saved and the rest is wasted. The stumps remain in the soil indefinitely, and cause it to be of little value.

Out of these stumps and the rubbish that is burned there is (or, rather, there was at the time) a daily waste of 40,000 tons of paper, 3,000 tons of rosin, 300,000 gallons of turpentine, 600,000 gallons of ethyl or grain alcohol, together with the fuel

In the manufacture of the fine grades of linen paper, from boiling the rags through the bleaching to the final beating, chemistry works its magic. Here in the great beaters a number of complicated chemical processes take place, few of which are thoroughly understood.

for these industries, besides the lumber we get as it is. The recovery of some of the products is just beginning.

We need a new bleaching agent in place of chlorine. The use of cotton is away up, and it is not growing more plentiful. Production of cotton goods is not increasing, and all of us, rich and poor alike, have to wear shirts and underwear.

Studying Cotton

In some exhaustive laundry tests directed by W. F. Farragher it was found that men's collars

that were washed and also bleached broke after from seven to nine turns through the laundry, while a control series, which had been washed, but not bleached, stood twenty-five similar turns before they gave out. Cotton thread that broke with a weight of 1,750 grams was washed and bleached twenty times by the regular laundry methods; then it broke with a weight of 100 grams. Thus we keep buying cotton cloth at present prices, and destroying it, not by wear, nor yet by washing it clean, but by bleaching it.

There's no use in scolding or grumbling or finding fault with people for not doing what we do not know how to do ourselves. These problems are

solved by research rather than by lucky strikes in invention. When it became necessary to detect submarines in order to win the war, to find out where they were so that they might be destroyed with depth bombs, the mails were full of proposals and inventions sent from all over the country to the Naval Advisory Board. Not one in ten thousand of these happy thoughts was worthy of attention. The solution was reached by ten selected men, all of them physicists of the first rank, working in collaboration with selected colleagues from Allied countries.

There isn't any such thing as democracy in science in the sense that one man is entitled to the same consideration as another. The more a man knows, the keener his understanding and the livelier and more active his imagination is in regard to the workings of atoms and molecules and ions and the forces of nature, the more superior is he to the rest of us, in the scientific sense.

It is very much as if we were on a ship at sea, when the problem to be solved is to steer the right course to reach our destination. Experience teaches us that it is better to leave that problem to the captain, who is familiar with navigation, than for a thousand passengers who are not familiar with navigation to offer their advice, their opinions, and their notions of what is the best thing to do.

Some Tanning Discoveries

Tanners have needed chemical help for a long time. We used to think that the longer the time spent in tanning the better the leather was bound to be; but it is not so. What is needed is good head-work rather than mere waiting. When the pelts of animals are allowed to remain moist they rot, whereas if they are dried they become hard and heavy. The art of tanning consists in converting that animal matter in the hides which will rot into permanent material at the same time soft and flexible, according to the use to which the leather is to be put. The work must be done thoroughly, but it is just as easy to soak a hide too long as not enough.

Chrome tanning of leather was undertaken abroad by cumbersome and ineffective methods. A much better process had been worked out and patented in America, but it was overlooked and forgotten by the tanners until they engaged a real chemist to look into the subject generally. He developed the American process for them, and soon 95 per cent of all the upper leather produced in the country

was chrome-tanned in the new way.

Leather is scarce and high. But it was neither a fisherman nor a tanner who added shark-skins, which are rapidly coming into the present supply. It was Dr. Allen Rogers, of Brooklyn, who teaches industrial chemistry at the Pratt Institute and conducts a course on the technology of tanning.

A great number of machines could be made much lighter than they are by the use of proper alloys of steel to meet the requirements of each member of the apparatus.

Farmers' Problems

How does it come that farmers buy "complete" and mixed fertilizers, composed of small amounts of needed chemical bodies mixed with large amounts of filler, and pay heavy freight charges on what might cost them but a fraction of their present expense?

The only trouble is that we don't know enough yet—don't know what our soils require and what our crops demand; and so we put on, in effect, a patent medicine, which is likely to contain what is needed as well as what is

not. But think of the expense! I repeat, however, there is no use in scolding unless we are ready and competent to go to the farmer and tell him just what to do and how to do it.

We could go right on down the list through nearly every industry and point out where science can help. The main thing is to know this and to feel it. Then we can ask for help, and very often we can get it. It is not chemistry alone that is needed, however. There's botany, for instance, that we used to think a pleasant study for young ladies and children, on the ground that it would not corrupt their tender minds. But some remarkable hybrid trees have been developed that produce wood as firm and as good as the original wild trees, but which grow to maturity with surprising rapidity. It is time to begin to think of those trees in problems of reforestation, and to encourage the botanists and foresters and arborists to go on with the good work.

There's another thing to be borne in mind in bringing about these improvements. They have to be paid for, and they cost a lot of money: first, for the research in laboratories, then for industrial development, because factory work is different from laboratory work, and finally for introduction. A patent lasts seventeen years, but it usually takes from eight to ten years for a successful invention to develop, if it involves any change in the habits of persons.

We Fight Anything New

It is really surprising how we fight against anything that is new. We do this because we don't want to be misled, and there are unfortunately always some persons who are seeking to mislead us; and this makes us wary. But why do we have to be wary? Because we do not know enough to tell whether a proposal really has merit or not. If we knew more we should not need to be so cautious.

Then, too, very often we think we know when we do not. It requires rich men who can afford the risk to foster inventions, but our income tax laws discourage them from doing so, because if the invention fails they lose their money, whereas if it succeeds well enough to make the chance worth taking, the proceeds are taxed away. I am not complaining against the income tax with its surtax on large earnings; I am merely stating the fact that it hinders the development of inventions, of which some are sorely needed for the general welfare.



When this fine long-leaf pine-tree is cut down, two thirds of it is destroyed as waste. According to an investigation made about ten years ago, if the entire tree were used, as it should be, the long-leaf pine industry would yield every day in America 40,000 tons of paper, 3,000 tons of resin, 300,000 gallons of turpentine, and 600,000 gallons of ethyl or grain alcohol, together with the fuel for these industries, in addition to the lumber that we now obtain

This School Expands to Fit the Pupils

THE "unit plan" of school housing is coming to stay, in the opinion of officials of the United States Bureau of Education. It substitutes for the usual large factory-like building a series of cottage school-rooms clustered about a central campus. Born in the West, it has been employed most extensively in Colorado and California. Open-air schools have practically doubled in number each year since they were first introduced in Providence, R. I., in 1908. There are now more than six hundred such schools in the United States.

In the unit plan a single room or several, as required, may be built on to meet the growing needs of the particular locality, the increased school space keeping pace with the increase in school enrollment.

Since each class is housed by itself in one small one-story structure, there is less chance of fire. If by any chance



"Unit plan" schools such as this can grow as the number of pupils increases, and they are said to be safer and more healthful than the ordinary kind.

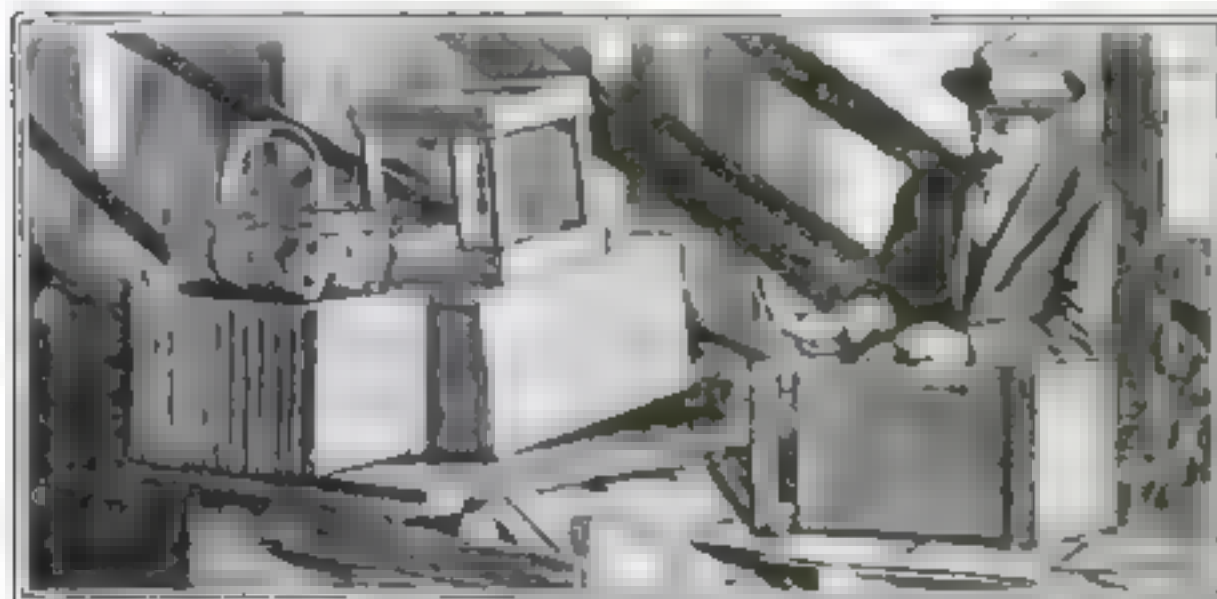
fire should break out, there is less likelihood of loss of life and damage to the entire property.

One of the best plans for this unit grouping suggested by New York and Denver architects provides for a central building somewhat larger than the class units, to serve as an assembly

hall, and containing the principal's office and a room for the teachers. On each side of this administration building are grouped the individual classrooms.

One of the advantages claimed is that unit-plan buildings are more easily heated than a single large one.

Making Crates of the Once Useless Cottonwood



Cottonwood strips are made into egg-crates, butter boxes, and baskets; the wood is white and odorless.

A COTTONWOOD board or strip will curl up like a cart-wheel soon after it is cut. If you try to straighten it out by nailing it down, you will find that the wood is strong enough to twist back to its warped shape and take all the nails with it. Is it any wonder, then, that cottonwood lumber has not been used in the past?

But Mr. Roy Nelson, of Manhattan, Kan., has experimented with Kansas cottonwood, and now he finds that, if it is properly cut and dried, it will follow the straight and narrow path, and may be used for making baskets,



In this cutting-machine the cottonwood log is revolved and a knife slices off strips.

boxes, and egg-crates. The cutting-machine he uses is shown in the lower picture. First, logs are sawed into blocks of the length of the box to be made. One of the blocks is hoisted over the cutting-machine and then lowered into a set of clamps. These clamps are made to revolve, and the block turns with them. As it goes round, a long, sharp knife peels off slices of the required width and thickness. The knife can be adjusted to cut slices from one eightieth to three eighths of an inch in thickness.

A sixteen-inch log can be peeled to the core in three minutes. Then the core is sawed into boards and used for making box-ends. The wood is dried and made up into butter-boxes, egg-crates, chicken-coops, and baskets.

Kansas cottonwood is hard, tough, light, white, odorless, and is better suited for box-making than either Southern or Western cottonwood. According to Mr. Nelson, there is no danger of exhausting the supply of wood, for it grows faster than he uses it. On the river flats several twelve-inch trees have grown since the flood of 1908.



Down in one of the galleries of a salt-mine, the work-ers watched a moving picture of "safety first" lessons.

Safety First Moving Pictures in a Mine

A LARGE liability company wanted to prevent accidents in a salt-mine for which it was liable. One day representatives arrived at the mine with a moving-picture machine and a reel of "safety first" object lessons.

Instead of calling the miners up, the representatives went down into the mine with their picture-machine and set it up in one of the great rock-salt galleries. A sheet was stretched across a wooden frame, and current from the power-house furnished the necessary light. The work-ers were called from all corners of the mine and, seated on the salty floor, were given their movie lesson.

Digging 50,000 Trees a Day

THE nursery tree digger has been devised by Edgar A. Jackson, of Cupertino, Cal. It consists of an auto-mobile engine supported on a frame mounted on runners, which may be anchored in alignment with a row of trees, shrubs, or bushes, and used to operate a cutter for rapidly removing the trees or shrubs.

With this machine 50,000 trees may easily be dug in a day, using about ten gallons of fuel. The gas-engine is geared to drums attached to cables, which in turn are attached to the cutter device. The gear reduction gives a tremendous pull, and holds the cutting knife with a very large lifter, making the hand pulling of the trees easy. The machine moves from one row to another by its own power.

Some of the important features of the machine are that the trees can be dug as deep as desired, in dry or wet ground, the trees are not injured, and a space of twenty feet is ample for operating the machine.



A machine for digging up trees. It may be set up in alignment with a row of trees and remove any that may be desired.

This monster crab was found off the coast of Japan, it measures twelve feet across its outstretched legs



An Ugly Giant Crab of Japan

OFF the coast of Japan the spider-crab is of such gigantic size that it is considered one of the wonders of natural history. It is the hugest of all the crustaceans, and looks more as if it belonged to the days of the dinosaurs than to our times.

The crab shown herewith is in the American Museum of Natural History in New York. It measures twelve feet across its outstretched legs.

Japanese divers are in mortal fear of this monstrous crab, believing that some day it will "get"

them while on the bottom. But there is really very little ground for this fear, for, despite its formidable size, this giant is a slow, stupid creature, stalking awkwardly through the gloom on the sea-bottom at depths usually very much greater than those to which divers descend.

The British Museum contains a very large spider-crab with a span of eighteen feet.



The Korean farmer, dressed in white walks behind this crude plow drawn by an ox.

In Leisurely Korea

WITH an iron-shod wooden plow, a large shovel worked by four or five men, one guiding the handle, the others jerking the blade by ropes attached to it, with a bamboo rake, a sharp-pointed hoe, and a few other crude implements, the farmer of Korea sets his eye upon the weather and cultivates his land.

In Korea the sun shines and the rain falls as it does upon the rest of the earth. Light, sandy loam, disintegrated lava, and rich alluvium reach to a depth of from three feet to ten feet.

The farmer in his white dress walks behind the crude plow as it is dragged along over the loose soil by a patient ox. Even with these primitive means, the Korean farmer is able to bring forth two crops a year.

Rice, millet, beans, cotton, hemp, oil-seeds, wheat, oats, barley, and sweet and Irish potatoes are the chief products brought from the soil by the labor of the men and oxen.



They're hauling in a German mine that was floating around in the Atlantic.

Working with Death

STANDING on a few hundred pounds of TNT isn't the safest job in the world. It was a necessary one, however, when the United States navy was clearing the mines from the North Sea. Our men were after the American mines laid to keep in the German submarines, but once in a while they found some German mines which had floated loose from their base. These mines will be taken apart by experts.

The United States navy took up more than fifty-five thousand mines in less than six months—probably the most difficult work done in connection with the war by any naval force.



Carried in his pocket the mechanic makes use of canned heat to supply the fuel for his soldering iron.

Canned Heat for the Soldering-Iron

TROJANTS have found that canned heat is just what they need for cooking their meals by the wayside.

But this is not all. The little ten-cent can of condensed heat also helps the mechanic who has a piece of soldering to do. The iron can be quickly heated and the broken pipe or piece of metal soon mended.



© Keith & Herbert

A fifth leg growing out of a good-luck hump on her back saved Bossy's life.

Bossy's Fifth Leg

BACK on the farm Bossy's brothers and sisters had always laughed at her fifth leg. It grew out of her neck and hung limply over her left shoulder. As Bossy went from calfhood into cowhood a hump developed at the spot where the fifth leg grew. Truly she was the ugly duckling of her family.

But when she arrived at the slaughter-house, her much-abused hump and leg saved her life. The hump was looked on as a token of good luck, and her fifth leg put her in the class with freaks. The butchers decided that they would make more money by selling her than by killing her.

Bids from zoos, circuses, and museums will be carefully reconsidered by her present owners.



When a cup is filled the wheel turns slowly and the bait-cup drops into the basin of insecticide.

A Trap to Catch Ants

THERE are elephant-traps, and there are mouse-traps; now there is invented a trap to catch ants! It consists of a magazine having a zigzag channel holding cylindrical cups in which bait is deposited. A spring-motor or a small water-wheel operates the trap, permitting the bait to be exposed for a sufficient time to attract the insects, then allowing the end cup in the row to be dumped into a basin filled with an insect destroyer.

Each bait is formed from a roll of cotton gauze saturated with a sticky material intended to appeal to the particular taste of the ants. Beetles, flies, and other pests may also be allured into the trap, automatically to meet destruction in the solution in the basin.

At the end of the channel the bait rolls into the arms attached to the wheel, and this slowly drops the can into the liquid, automatically throwing back the wheel and making ready for the next bait-cylinder.



He carried this apple tree from the East to the West sixty years ago, and it still bears fruit.



He carries his tools in a close case that weighs very little.

He Carries His Tools with Him

AN order comes to the job foreman summoning him to work upon the wooden forms of a new skyscraper. The framework forms are necessary before the concrete can be poured, so the carpenter takes his tools and starts for the job.

Will he have to carry them in a heavy tool-box? Not if he is wise, and if he has become acquainted with a recently invented serviceable tool-kit. This kit is so light and compact that it can be strapped over one shoulder. The tools are protected and well managed as a unit. The carpenter can have access to them at a moment's notice, and when going up a ladder finds the kit more conveniently managed than a box.

When the day's work is done the tool-case is easily hung by its strap to the wall of the tool-room.

An Apple-Tree of Sixty

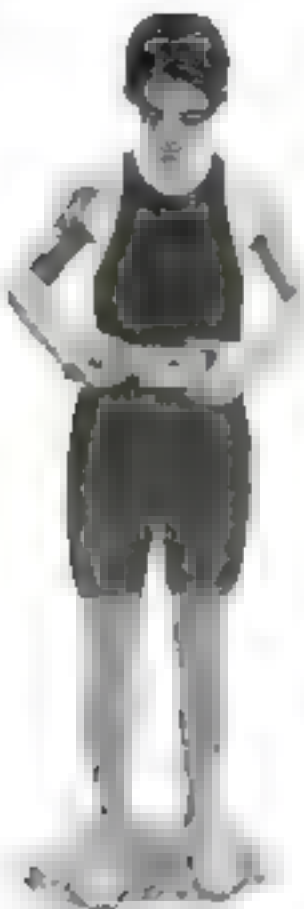
IN 1868 a Missouri farmer decided that he wanted to take Greeley's advice and go West to do a little growing up with the country. He took with him a tiny apple-tree growing on his farm, to see what luck it might bring him.

From all appearances he made a wise move, for the tree is still growing and showering apples all over the orchard each year.

In 1897 the tree was badly scorched when the farmer's house burned down, but no serious damage was done.

The tree bears heavily every other year, and even in "off" years it has a fairly good crop. In 1914 there were sixty-five boxes of the finest apples picked and packed from this one tree.

This remarkable patriarch is a Rhode Island greening.



He carries his money in a water-tight safe on his belt

Take Your Money with You When You Swim

YOU come out of the water after a swim and you're hungry for a frankfurter and roll. But you haven't any money with you—no place in your bathing-suit to keep it; so you pass up the frankfurter.

Now there is a new belt for bathing-suits that has a small metal safe fastened to the buckle. It is absolutely water-tight and will shelter dollar bills from the briny deep.

After you have put your money inside the safe you screw on a metal cap and think no more about it until you are hungry

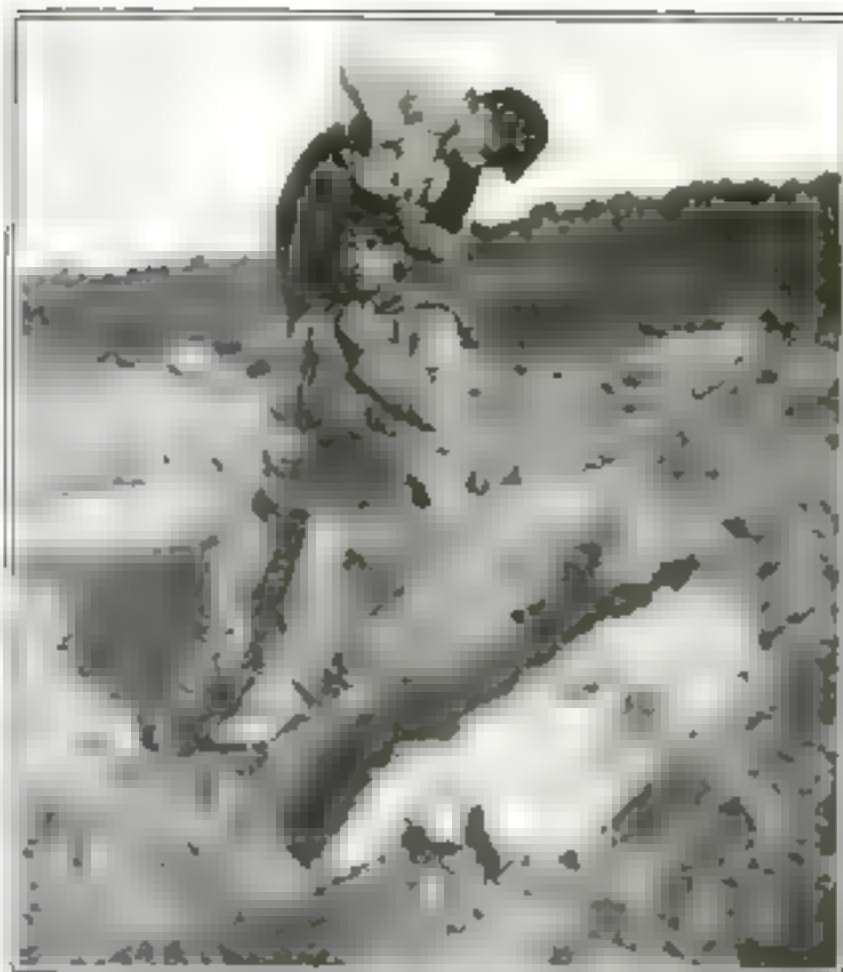
Weighing Crops in the Field

A SIMPLE but effective method of weighing small quantities of hay or other farm crops in the field has been devised by a Klamath County (Oregon) farmer.

Desiring to weigh a certain quantity of alfalfa with which he had been experimenting, but finding the stack too heavy and cumbersome to be lifted, he overcame the difficulty by taking two stout poles, about eight feet long, and crossing them securely near the top.

Through the notch thus formed he passed a third pole, to the end of which a small scale had been fastened. The scale in turn was hooked into a rope passed around the stack of alfalfa, and the load was easily lifted from the ground by working the cross-pole as a lever.

The soldier in the picture is glad to be back on the farm he used to find so dull.



Every Cree Indian is his Indian companion's barber; he never charges anything for the hair-cut or shave

An Indian Barber-Shop

USING the reflection from a pool for a mirror, with the open sky for a ceiling and a grassy plot or a dirt-bank for a barber's chair, the Cree Indian has his hair cut.

For two hundred and thirty-nine years the Hudson's Bay Company has employed as trappers and hunters the Indians and Eskimos living on the shores and inlets of Hudson's Bay and as far west as the Pacific. From the millions of acres in the unknown north come the valuable pelts of fur-bearing animals.

Every Indian is a barber to his Indian companion. There is no charge for the service—the result often being of such a nature that the victim should be paid for the operation.

During the months of June, July, and August the Cree is fishing and preparing his traps and snares for winter, drawing wood, and visiting the trading-posts.

Though living outdoors, few are long-lived. Tuberculosis is common among all the Indians of the Northwest, and is due, no doubt, to their careless manner of living.



A spring-scale is attached to a pole and the outfit is easily carried from place to place



This clock has thirteen pairs of hands, and it tells time all over the world

Telling Time All Over the World

WHEN it's quarter past eight in New Orleans, it's seven minutes past four in Constantinople, ten past two in London, and quarter past nine in New York. You may get similar information about nine other cities if you look at the clock in the picture above. This clock's home town is New Orleans. It was built in the days of the Civil War.

The thirteen pairs of hands on the old clock's face go round together and are operated by one set of works that is wound up regularly every seven days.

Hand - rest, light and paper on which to write in the dark

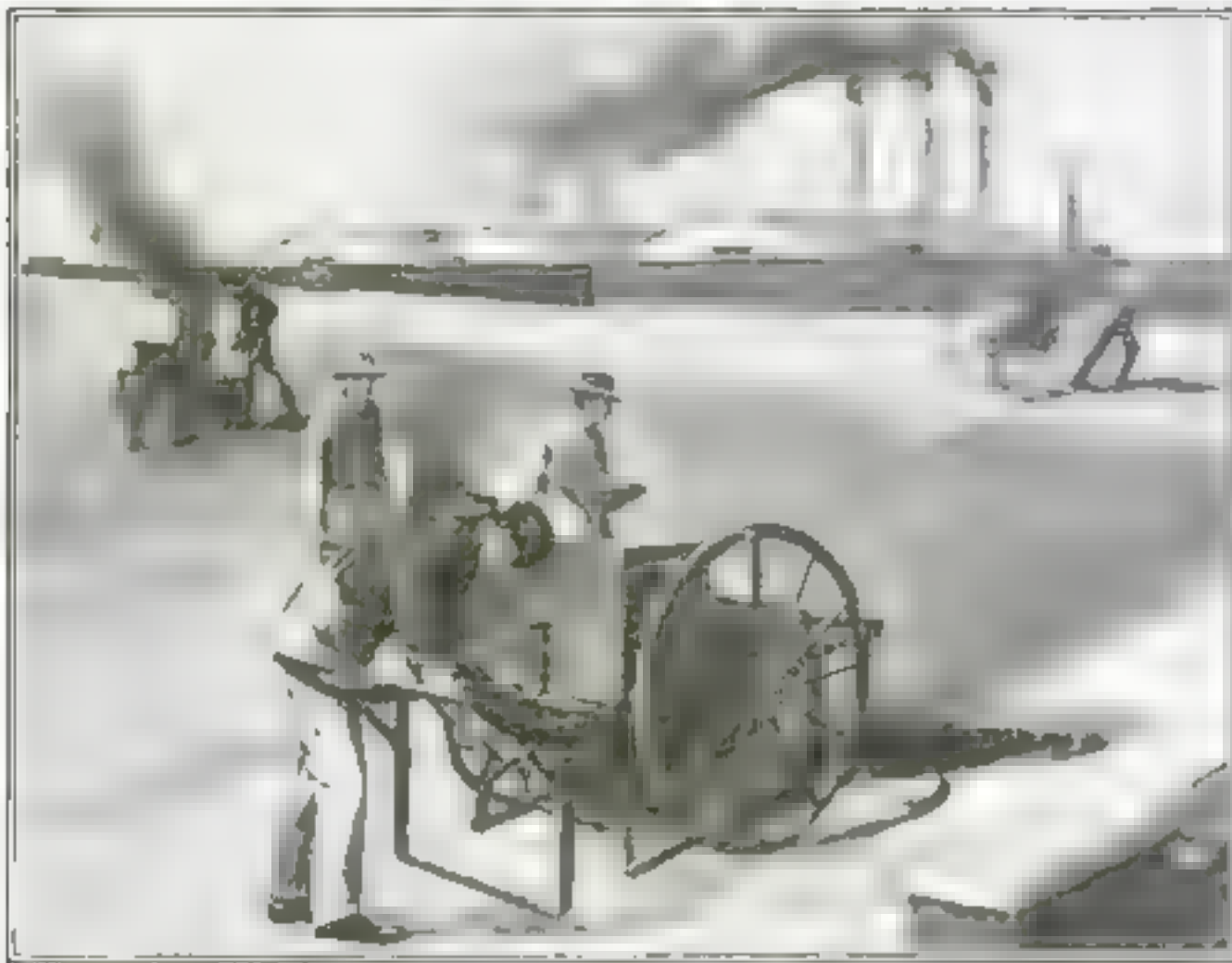


Notes by Pocket-Light

THE corner policeman who wishes to make a memorandum in his note-book, and who does not wish at that instant to step out into the light to do so, has at his service a convenient combination of note-book and pocket-light. Nurses, doctors, and detectives can make use of it when writing in a dim light. Artists who want to make sketches in pencil in the dark, astronomical observers who wish to jot down the path of a stray meteor and do not wish to trust their memory until they can get indoors, also army and navy officers making notes at night when it is necessary to do so in the dark, will find in the pocket-light note-book a worthy friend.

This novelty is about the size of an ordinary pocket-light. It has an extra hinged surface upon which rests the writing-pad, and is so constructed that the regular lid of the light-compartment serves as a rest for the hand when writing on the paper pad.

Laying a Roof by Machine Saves Time



As the machine crosses the roof the liquid tar drips in front of the paper and a roller presses the paper into contact with the cement

A LABOR-SAVING device has been patented by which a large roof area may be covered with roofing material by means of an easily managed machine.

Where alternate layers of tar-paper and asphaltic pitch are to be spread

over a large area the process usually employed involves several separate operations. The tar is distributed and the paper unrolled upon it. Then the workmen must press down the paper until perfect contact is established. The machine carries a tank

filled with liquid pitch. A pipe conveys the liquid directly in front of a roller around which passes the sheet of tarred paper. This sheet is continually automatically unwound from a roll carried in the upper part of the machine.

As the machine is guided around by hand, it moves upon two large stable wheels and automatically permits enough pitch to flow in front of the paper-roller to cement it in contact with the roof. The weight of the roller presses the paper down upon the pitch. It is thus a simple matter to put on as many layers of the pitch and the paper as are required.

The machine can operate on a slanting as well as on a flat roof, though the pitch of the roof must, of course, not be too great. Any device that saves time also saves money, and the method of laying a roof by use of this labor-saving machine is an important economy.

A Life-Line Gun that Can't Fail

SHIP aground off Cape Cod? In a short time life-savers stand on the beach, ready to hurl life-lines to the helpless vessel. Most life-line guns are fired by means of bags of powder that are rammed into the barrel. Should the powder get wet it will be useless.

But now there is a gun in which the projectile and the powder charge are connected. The powder is contained in a cylindrical water-tight cartridge-case at the base of the projectile. Tests were made in which the cartridge was immersed in water, both fresh and salt. When it was put into the barrel and fired, it went off without a moment's delay.

At the other end of the projectile there is a long stem to which the life-line is attached. The line is wound up in a tin can, so that it won't get twisted. When the projectile is shot off, the line goes with it.

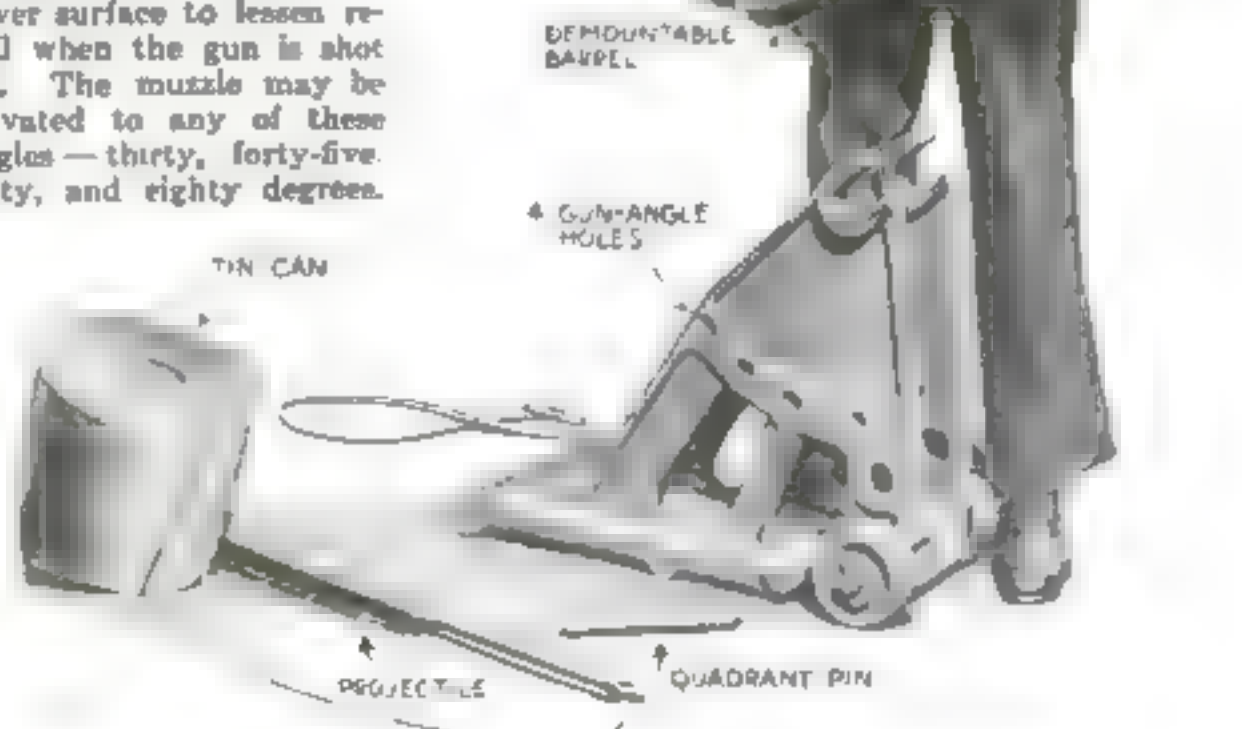
The gun itself is mounted on a heavy base, which is provided with two front



Showing how cartridge and projectile are connected in a new life line gun

The projectile and powder are connected the powder is placed in a water tight cartridge in the projectile

wheels and teeth on its lower surface to lessen recoil when the gun is shot off. The muzzle may be elevated to any of these angles—thirty, forty-five, sixty, and eighty degrees.



Rich Iron-Mines in Air We Breathe

Every year millions
of dollars are lost
in the cities' dust

By Edwin O. Pierce

WHEN is a city street an iron-mine?" The answer seems to be: "When the street is in a big iron and steel town."

A recent investigation of smoke and dust in Cleveland, Youngstown, Pittsburgh, and other centers of the iron industry revealed the fact that iron can be extracted not only from the dirt of streets, but from rugs and carpets, the walls and roofs of buildings, and even from the skins of the inhabitants!

The very air of these districts is laden with fine particles of iron dust, which, together with the soot, get into the eyes and lungs as well as upon the hands and face.

This investigation began with a microscopic examination of vacuum-sweeper dust, by which it was discovered that the dirt accumulating in a small rug in a day's time contained an amount of iron equalling a five-cent piece in weight. Other experiments were then made, demonstrating both by magnetic separations and by chemical analyses the presence of iron in the many places already mentioned.

Every kind of iron-furnace produces a certain amount of dust, but the larger part was traced to the Bessemer converters, which take molten iron from the blast-furnaces and change it into steel.

The Bessemer converters are great hooded pots having air-jets in the bottom and holding ten tons of metal. They are so mounted that they can be tilted to receive and pour out the charge. When the air is admitted, a huge saffron-colored cloud is the first result. This cloud contains the oxides of iron and manganese. Then a shower of sparks, called the "silica blow," is followed by a great tongue of flame about thirty feet high, due to the burning of the carbon.

Since these converters are like gigantic atomizers, they necessarily blow out a spray of molten iron and slag as well as oxidize the impurities. The tiny molten bubbles cool and harden as soon as they reach the air, but are carried considerable distances before they finally fall to the ground and are crushed into fine dust.



The "big brown smoke" coughed up by a Bessemer converter every few minutes. Without the prevention of iron dust, the fine particles of iron and manganese blow into the air and are carried about to a great extent.



Picking up iron dust on the street! In the vicinity of the steel-mills quantities of iron dust are carried in the air and deposited in a fine powder over houses and streets. One can take a bar magnet along and collect much of this dust from the pavements.

The amount of iron dust falling upon any given area is a difficult matter to determine exactly, but a series of dust-collecting experiments was made in the city of Youngstown, which is rapidly becoming the largest iron and steel center in the country. From the results of these experiments it was calculated that about sixty-five tons a day of actual iron from all sources falls upon an area of one mile radius in the heart of that city. And from this calculation it would follow that in the Youngstown district alone about one hundred and fifty to one hundred and seventy-five thousand tons of iron are blown away every year and lost to mankind forever.

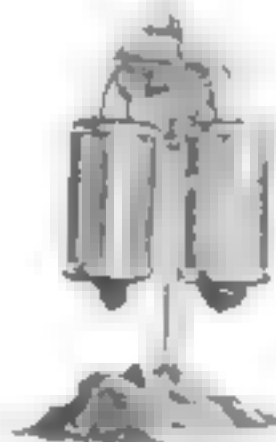
To the value of the iron must be added that of the manganese, also lost. This is an expensive element of which the country has

very little. It is present in the blast-furnace iron, but in the Bessemer process we blow it away and then use money, ships, and men to get more, for it must be present in the finished steel.

There are a number of systems of dust collection. The best known method and the one that seems most suitable for iron dust is that of electromagnetic separation known as the Cottrell process. In employing this method the smoke is led through chambers in which are suspended long wires charged with electricity. A silent discharge is constantly taking place between these wires, and the particles in the smoke, also becoming charged, collect into groups and settle upon the wires or floor.

Because of its long flame and the necessity of being turned, the Bessemer converter is usually operated in the open. The problem of confining Bessemer smoke would seem to be a difficult one, but surely not beyond the bounds of American ingenuity. Once collected in a chamber, the separation of iron would be easy.

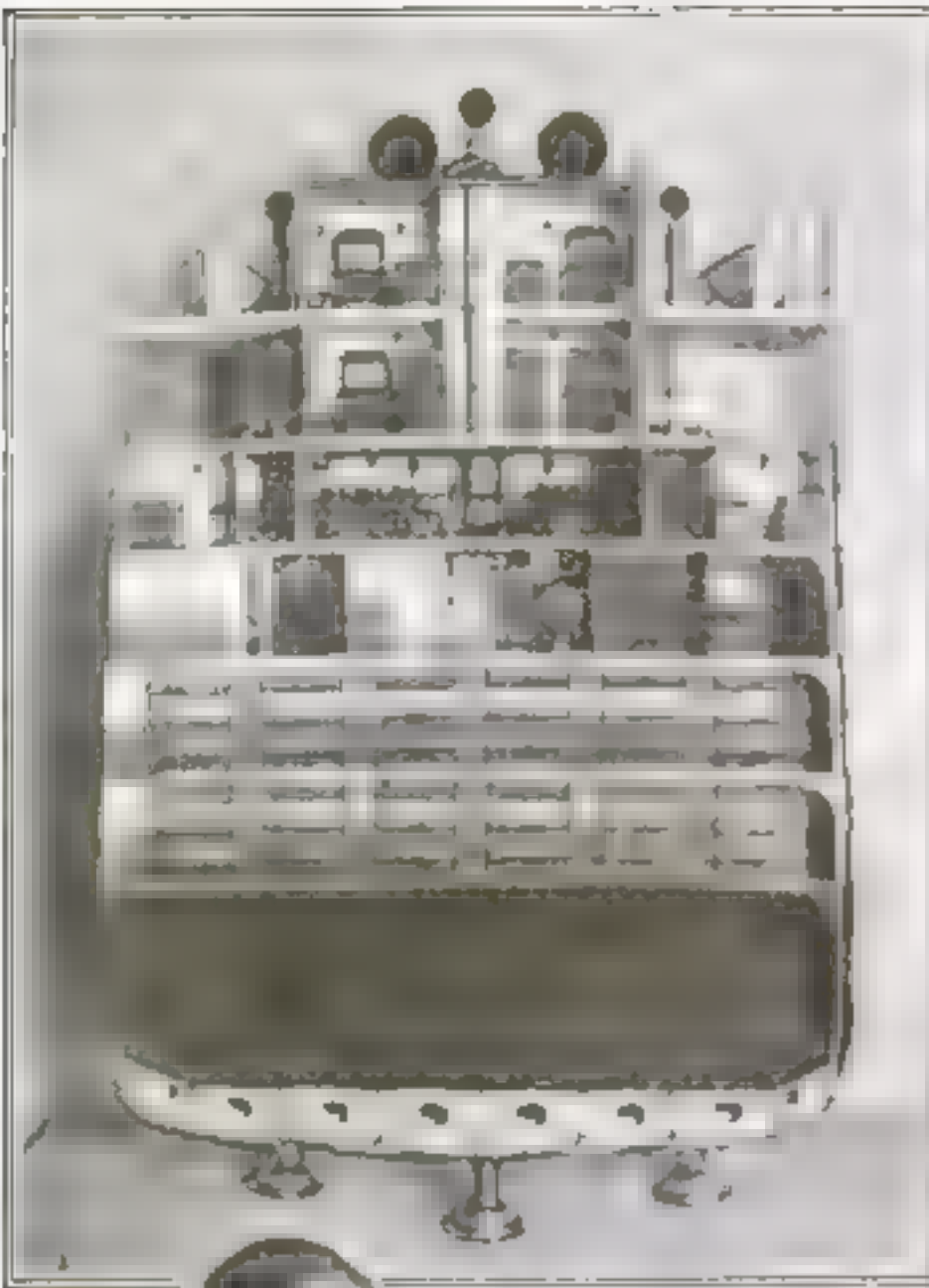
The iron dust could be heated until it became a solid mass or partly melted into solid pieces, and then returned to the blast-furnace.



From the sweepings of a vacuum cleaner used on a Youngstown, Ohio, rug the electromagnet draws to itself the iron particles, the dust that was carried through the air from the steel mills.

Stay-at-Home Models of Ocean Travelers

The ship-owner's reference library



But the model is not a mere toy. It is a reference library for the ship-owner.



Here is a model of a battleship. It is a reference library for the ship-owner.



Wood that is well seasoned to prevent warping is selected, and the pieces are glued and set. This is the first process.



Here is a ship that has just received its smokestack. Cabins and deck have already been carved out. There has been such a demand for model ships in recent years that one New York factory devotes all its time to making them.

Ask Dad—He Knows!

Once familiar things that have fallen behind in the march of progress



The wooden Indian! It used to stand boldly in front of each cigar store, staring sternaly into space

Chasing after fire engines was lots more fun when Dad was in knee-breeches than it is today. The high spirited horses clattered down the street, shooting sparks and making much more noise than motor driven engines



When you wish to move, today, you hire a powerful moving van. In father's or perhaps granddad's time, prairie schooners did the work



When Dad was a boy one of his ambitions was to drive a horse-car but when he grew up the horse car had disappeared almost entirely



Dad practised archery when he was a boy. All the boys enjoyed it. Some of them still keep it up in Washington Park, Chicago

That cry was repeated by "Taxi" at about the same when there began the slogan of our American cities



If Dad had wanted to go from San Diego to Silver City in the 90's he would have climbed onboard this rickety stage-coach

Across the river in an old fashioned ferry-boat guided by a strong wire cable



So Powerful Is This Searchlight that It Melts Lead

The metal liquefies at a distance of twelve feet

By Latimer J. Wilson



© Kaid & Herbert

So powerful is the beam of the Sperry searchlight that a cigarette can be lighted in the outer border of the rays. The sunlight is so closely rivaled in the new arc that moving pictures can be taken in it with the speed required for genuine sunlight.

HOW bright is the sun? In candlepower the sun's intrinsic brightness, as seen at sea-level, is equal to the light of 270,000 candles for each square inch of its surface. The crater of an ordinary electric arc is equal to 84,000 candlepower on the same scale. Now the sun has a closer rival in the dazzling brilliance of the new Sperry searchlight, which has a total luminosity of 1,280,000,000 candlepower!

The rays of light from the arc are projected in parallel lines by a sixty-inch parabolic mirror. Allowing for the loss of light in reflection, the searchlight carried out into space would be visible at practically the same distance from the earth as would an equal area of the sun. A piece of the dazzling solar disk clipped into a circle sixty inches in diameter would have a rival in this searchlight. What a strange cosmic effect could be witnessed when the shaft of light sweeps across the sea to meet the rising sun!

Standing in the blinding path of rays emanating from opposite directions, the observer would notice that, for the first time in his life, he could stand in the direct sunlight without casting a shadow! The flame of the ordinary electric arc is itself cast as a shadow in sunlight when held a few feet from the ground. At a given

distance the beam of the Sperry searchlight is about equal to the total light of the sun when the latter is well up in the sky above the horizon. Concentrated against the light of the sun at such a time, the searchlight actually equals the sun, and becomes such a formidable rival that it can counterbalance the shadow-casting power of the great orb of day.

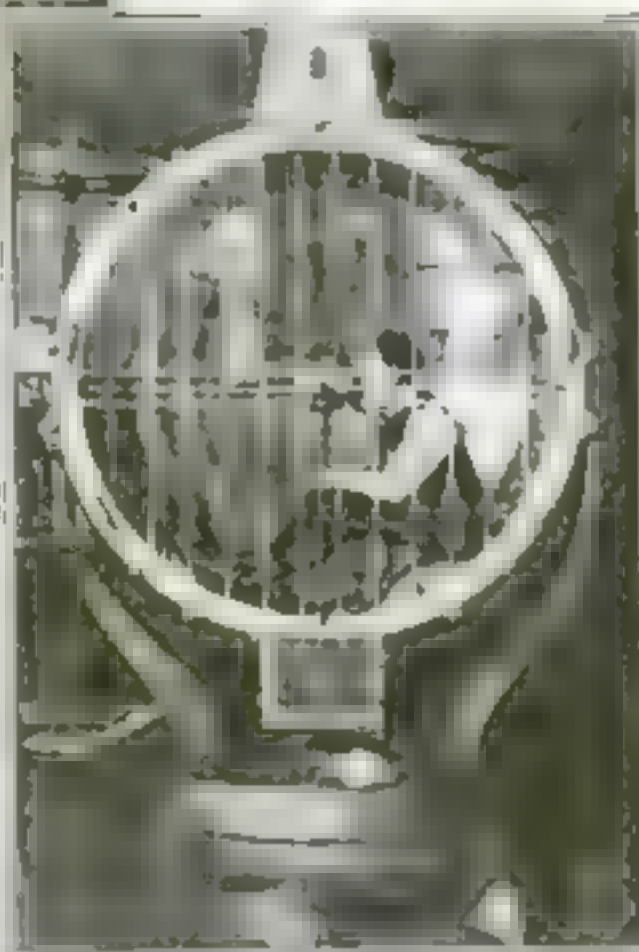
This marvel of searchlights was invented by Elmer A. Sperry. It consists of an automatically rotated positive

constant flame. The superior power of this new searchlight depends upon the intensity of the illumination of the gas which fills the crater of the positive arc. But for the device that makes possible the retention of a perfect crater whose image is projected in parallel rays from the huge sixty-inch mirror, the power of the arc would not have exceeded that of other searchlights.

One type of searchlight can be operated from a distance of ten miles. Stationed upon the summit of such a mountain as Pike's Peak, the control of the light could be managed from the city of Manitou at the base of the mountain. But it is customary for an operator to keep close watch upon the mechanism of these great searchlights while they are burning.

Of course, the light is far too bright for anyone to look at directly. An arrangement is provided by which the image of the carbons is projected sharply upon a ground glass at the side of the searchlight. The glass bears a vertical mark, and the rim of the crater must be kept exactly in line with this mark, thus showing that the crater itself is exactly in the focus of the parabolic reflector. So powerful are the rays that lead can be melted at a distance of twelve feet from the crater. A cigarette can be lighted at the edge of the beam of light.

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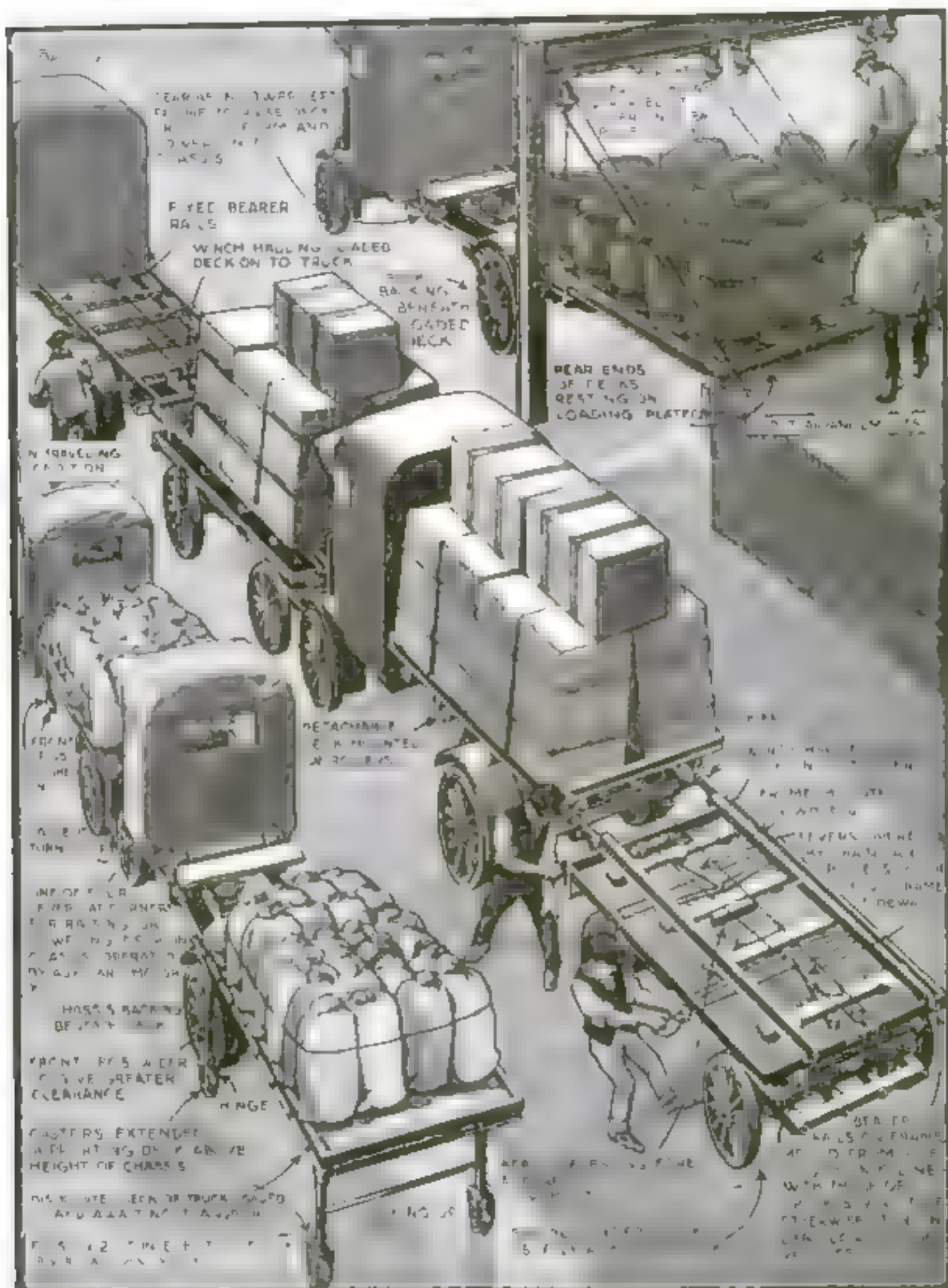
The largest searchlight. It has a candlepower of intrinsic brightness about equal to the sun itself, area for area. The size of the reflector may be judged by comparing it with the man

cored carbon which burns to a crater-tip. The negative carbon is held by silver-tipped "fingers," while the positive is held in an air-tight clamp tipped with quartz-crystal. The hot air is blown off by a motor-driven mechanism to keep the carbons and the great parabolic mirror at a safe temperature. The carbons are held at the proper distance apart and are automatically fed to keep a



The Sperry searchlight of this type can be operated by electric controls ten miles distant. Mr. Elmer A. Sperry, the inventor, is shown operating the controls

A Quick Method of Loading Motor-Trucks



WHEN a motor truck has to stand at the loading depot and wait until the boxes, bags, or barrels that comprise its load are packed upon it, the working time of the truck is enormously shortened. But if the body of the truck consists of a movable deck that can be readily and quickly slipped on and off, all the time that is lost in loading and unloading is the time required in removing and replacing the already loaded deck.

To relieve the congestion of rail transportation by quickly handling the loads of motor trucks, or "lorries," the use of these adjustable decks has been suggested by Mr. Cornadi in a paper that he recently read before the Institution of Mechanical Engineers in London. The

method enables a single workman to dismount and replace the body or deck of his truck in about five minutes' time.

A platform supported by two casters at the front and two at the rear is easily moved from the room where it is loaded, up to the back of a truck. The frame of the truck carries a pair of rails upon which the loaded deck can be slid and locked firmly. The frame of the platform also holds two rails to receive the deck of the empty truck when it returns for a new load. Workmen in the depot load the "decks," making them ready to be rolled over to where the trucks are coming to receive them. The illustration shows the stages in the process of loading and unloading with the adjustable decks.



Unscrew the cap on this fountain-pen and out pops a drinking-cup

A Fountain-Pen Cup

JUST as a fan will pop out of a toy gun, so a drinking-cup will pop out of a toy fountain-pen, the invention of Mr. James H. Watson, of New York city. The holder is made of hard black rubber and looks just like a fountain-pen. It can be clipped to a vest pocket and be entirely out of the way until it is needed.

When you want a drink you unscrew a cap that fits over the end of the water-container. Out pops the cup, which is cone-shaped and is attached to a spring metal frame.

The cup is made of the usual waterproof paper and may be easily replaced by a new one when the old cup wears out.

The inventor of the fountain-pen cup designed it especially for travelers.

Safety Devices to Guard the Power Press Worker

THE power press has a bad reputation. It has caused more accidents than almost any other machine. But now it is being equipped with safety devices that make accidents almost impossible.

Take, for example, the press that punches lids for tin cans. The lids are placed on an endless chain (B) by the operator, and she stands at least five feet away from the press itself. The chain carries the lids to the punch. Wings (A) automatically open and close, feeding the lids to the punch one at a time. Hundreds of lids are stored in a tray (C).

And now consider the press that cuts small perforations in tin can lids. Most cans of cleaning powder are provided with these lids. The operator places the smooth lid on a block (A) that is located in front of the punch. Between the two is a glass safety guard (B) that protects the operator and yet enables her to see what is going on in the press.

When she steps on a lever the lid promptly slides under the glass guard and takes its place in the press, and then the punch comes down.



(Left) The operator is perfectly safe when she punches tin can lids in this press. She feeds them to the press on an endless chain. (Right) When a lid must be perforated, it is placed on a block located in front of the press, but separated from it by a glass guard. It is operated by a pedal.



The celluloid window-shade keeps out drafts but not the sunshine

Air Without Drafts

A NEW arrival among shades is the celluloid window-shade, used to keep out drafts. It is fastened to a regular spring shade roller and has the customary stick through its lower end.

You attach it to the top of the window-frame just as you would an ordinary shade. Being transparent, it does not obstruct the view.

The ends of the stick may be fitted in grooves in the frame to keep the celluloid from curling.



With this mirror you can see an eye on the back of your head

She Sells Phonograph Records by Telephone

"I'LL take that—send it as soon as you can," says the lady at one end of the wire; whereupon the lady at the other end wraps it up. Wraps what up? A phonograph record.

With the help of a new amplifier, phonograph records can be distinctly heard over the telephone. The amplifier is placed between the phonograph and the mouth-piece of the telephone, and is connected with an electric circuit. When a new record is set in motion the buyer at the other end of the wire hears the production plainly and can readily tell whether or not she wants it.

An amplifier placed between phonograph and telephone enables the person at the other end to hear and decide whether to buy it



As Others See It

EVEN though the back of your head is not so interesting as the front, you may occasionally like to look at it. One mirror won't help you out, but two of them, properly placed, will show you just what the back of your head is doing.

Edward H. Roy, of Nashville, Tenn., has invented a special duplicate mirror. The two mirrors are fastened to the ends of an arc-shaped bar so that they converge slightly toward each other. A handle is attached to the center of the bar.



An enterprising shoe-polish manufacturer offers a prize of \$1,000 for an improvement on this device

\$1,000 Reward

WANTED: a shoe-polish box opener that will permit the box to remain airtight and will work indefinitely without breaking off, and that will always be in order. Any person with a mechanical turn of mind has a chance to improve the device at present being used and, incidentally, make the neat sum of \$1,000.

The volatile ingredients in the shoe-polish must be protected by an airtight box. If rivets are put in the metal it is scarcely practical to prevent the container from leaking and permitting the vapors to escape. To keep the device from breaking off and

riveted can be expressed thus: "Ahl! There's the rub."

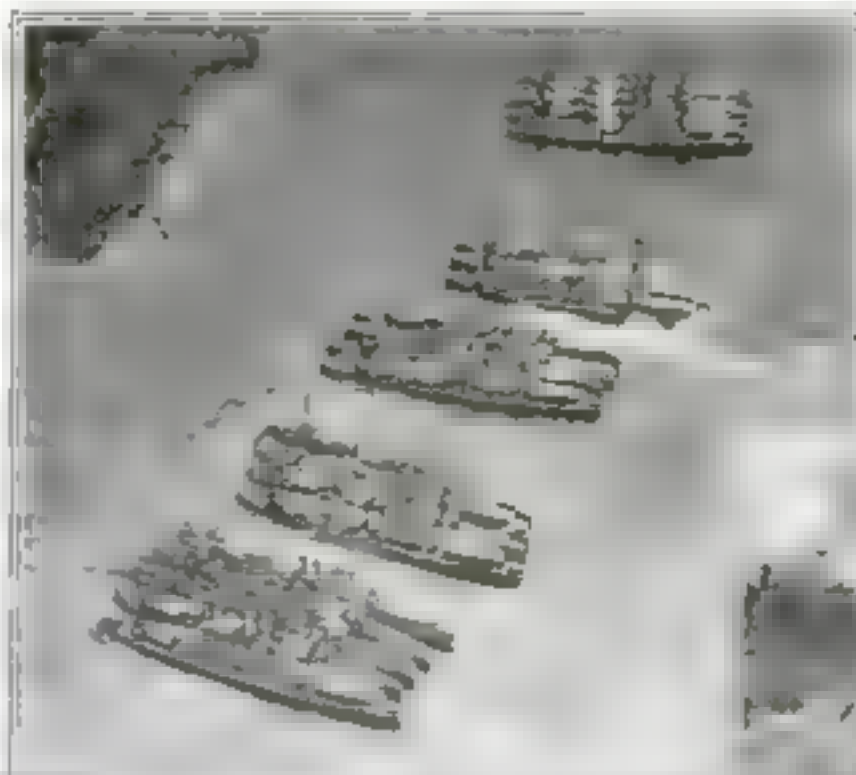
Twenty-one United States destroyers are grouped here just off the Pacific end of the Panama Canal.

These Harmless-Looking Boats Are Destroyers

VIEWED from an airplane, the twenty-one ships in the picture below look like a small boy's highly prized collection of toy boats in a mimic nest. They are United States destroyers at anchor just outside the entrance to the Panama Canal, and at that distance they look very harmless. Needless to say, they are not.

The boats are arranged in five groups, and all of the boats in each group are anchored to one buoy. They are lashed together, but have fenders between them to keep them from bumping into each other.

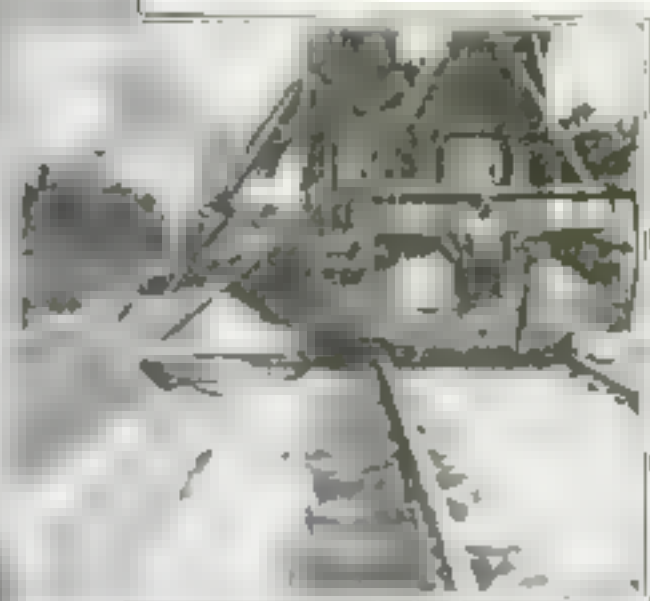
They are located off Balboa, which lies at the Pacific end of the Canal. They are only a very small part of the destroyer force of the Pacific Fleet.



Paraguayans drinking mate, a kind of tea that grows in South America

They Love Their Tea

"I have some tea," says a woolly South American. The tea is mate, a kind of tea that grows in South America. The natives of the region use it in a special way. They use a dried gourd. A tube of the mate tube holds the tea-leaves in their place.



An invention of Robert E. Bresler, of Indiana, for speeding up the work on railway road beds

Clearing the Railway Right of Way

INSTEAD of having a gang of many workmen going along the side of the railroad-bed shoveling away the dirt and rocks, while construction work is under way, a ditching mechanism has been devised to do the work with less trouble.

A side wing is mounted in a rearwardly inclined position on the construction car, and is pivoted, together with a carrying wing, so that it can collect the dirt as the car moves along through deep cuts, distributing it when the end of the cut is reached.

A heavy arm adjustably controls these "scrapers" and is operated by an air cylinder. It is an easy matter to adjust the slope of the "wings" to accommodate the slope of the ground at the side of the road-bed for drainage.

The machine does the work of many workmen and can travel through ditches at two and a half miles an hour.



Protected from giant boulders, this little house has stood for years in the mountains of Portugal

Boulders to Right of It, Boulders to Left of It

ON THE top of a hill a Portuguese goat-herdsman built himself a tiny house. There were no trees near by to shelter it from wind and storm, yet the house has stood for many years.

Boulders under it, on top of it, and all around it keep it firm. The walls are studded with small rocks; the roof at the rear of the house is weighted down with them. There's a boulder in front of the main entrance, another at the back door, and more along the sides.

The boulder house is situated in the Serra da Estrella mountains. Goats are raised throughout these mountains and the cheese made from their milk is very delicious.

The interesting question arises, "How did the boulders get there?" The smoothness of their form indicates the violent action of wind and water and the glacial currents that probably bore them down from lofty summits. Many times have they saved the cottage from the wind's fury.

He Has Built Fame with Cardboard

Berthold Audsley won success by finding a need and filling it

By Herbert Asbury

THE children who visit the Newark, N. J., Public Library and Museum know Berthold Audsley as the tall, kindly man who always has a twinkle in his eye, and who makes such wonderful locomotives, Indian tepees, medieval castles, and all sorts of interesting things out of cardboard and metal, and a few of the grown-ups in Newark, where he works, and in Bloomfield, where he lives, know him as the man who is in charge of the art work at the Museum. But there are others—few in comparison, perhaps—who know Mr. Audsley for what he really is—architect, designer, interior decorator, artist, and probably the foremost cardboard modeler in the world—surely the foremost in the United States.

An International Name

In the world of art and architecture Mr. Audsley's reputation and fame as a worker in cardboard are international. It requires but one glance at some of his creations to know why. His castles and his churches and his buildings of all sorts, all of them constructed entirely of cardboard and painted to resemble exactly the original structure, are marvels of intricate detail and faithful adherence to the original design.

It is actually impossible to distinguish between the photographs of the original structures and the photographs of Mr. Audsley's models. The writer failed in several attempts of this sort, scoring not a single time from a pile of pictures. One of these photographs was that of a model which Mr. Audsley had made for Gorham & Company, the New York jewelry and silversmith house, of the interior of the Lady Chapel of St. Paul's Church in Brooklyn, which was constructed by Gorham & Company's ecclesiastical department.

The model of St. Paul's Lady Chapel is one of the finest that Mr. Audsley has ever made, and it is an exact duplicate, in cardboard and in miniature, of the original chapel. It contains several thousand pieces of cardboard, and is three feet high, three feet deep, and eighteen inches wide, and drawn exactly to scale in every detail.



Combined skill of hand and brain enabled Berthold Audsley to build up an international reputation as a maker of cardboard models. He turned a hobby into a new profession.

Mr. Audsley began his work in cardboard modeling some eighteen years ago. Architects and artists and designers and constructors of churches and buildings of that sort have great need for accurate cardboard models, and the demand so exceeded the supply that Mr. Audsley began doing some of his own modeling. He took it up first largely as a hobby; but his interest in it grew to such an extent that the work soon became a part of his profession, and eventually practically his entire time was devoted to it, with the exception of that given to his work in the Newark Museum.

Models for England and America

During the last few years Mr. Audsley has executed commissions for firms both in the United States and in England, besides constructing many models for his own pleasure. He is now engaged on a museum piece, a model of the ancient dungeons of the Chateau Corcy, which was destroyed when the German army invaded France. This model will be complete in every detail

and will show the dungeons in color according to the original designs and the records of the chateau. When it is completed it will contain between 7,000 and 8,000 pieces of cardboard.

Mr. Audsley uses virtually nothing in his work but cardboard, although he has made the designs for a number of models in metal, assembling them after the pieces were cast. One especially fine example of this sort of work is a locomotive, oil-burning and capable of pulling several hundred pounds, which is on exhibition in the Newark Museum.

He doesn't do any work in wood, excepting to fit into his model a piece of wood where cardboard would not answer the purpose. But this is done so seldom as to amount to nothing.

Infinite Detail Necessary

The technique of this work in cardboard is replete with infinite detail and exactness. Every piece of cardboard that goes into a model must be cut exactly to scale and must be extraordinarily accurate in measurement. An error of

the tiniest fraction of an inch will grow, since the model is cut and assembled until it reaches what by comparison are gigantic proportions, and a slight miscalculation will necessitate the recutting of entire sections or groups of the design.

How He Does It

The first thing that Mr. Audsley does when he begins a cardboard model is to make drawings to scale, even down to thirty-two feet to the inch, which is the smallest he has ever attempted. These must be exact working drawings, as accurate and as correct in every detail as the working plans of an architect, and they must show every joint and wall and angle in terms of cardboard thickness.

After he has finished this task he divides the design into groups and sections, each of which is numbered and lettered, so that when the time comes for assembling he will know instantly just where every piece belongs. For instance, if a certain side-wall is in Group A, and is to be of four thick-

nesses of cardboard, it is so indicated on the drawings, and marked A-1, A-2, etc.

This being completed, Mr. Audsley makes blueprints of his building, and obtains elevations, all exactly accurate and correct; after which he plots the entire design on great sheets of cardboard. They are then ready for cutting.

Thus he does on plate-glass with a

very sharp knife; and as each piece is cut, marked, and numbered according to the drawings and blueprints, it is thrown into a big basket. Later the pieces are divided into groups, and when each group is complete the model is ready for assembling. The joints are grooved and tongued and made to fit exactly in all manner of ways; and where it is necessary they and the various pieces that go to make up the

required thicknesses are glued with pure gum arabic, which Mr. Audsley has found by experiment is best suited to his work. To prevent the bending and buckling that is so frequently found when cardboard is glued together he simply gums from the center out.

The model is then ready for painting, and after that it is ready for exhibition.

He Got Ten Thousand Dollars for an Idea

A. S. Wysong made brains beat hard luck

TEN thousand dollars for the best walnut-branding machine."

When Mr. A. S. Wysong, of Los Angeles, heard of this offer, he was nearly penniless. He had just been released from war service, and at almost the same moment he received word that a Utah mine he owned had unfortunately caved in.

Already an Inventor

He didn't know much about walnuts, and he had never branded anything, but he wanted that ten thousand. The prize was offered by the California Walnut Growers Association, and when Mr. Wysong heard of it the closing date was only a few weeks off.

Fortunately, he knew a great deal about machines. He had worked around them ever since he was a boy, and had invented one of the first light-weight tractors. During the war he served as a machinist's mate. His uncle was a well known inventor, and Wysong himself had taken out about thirty patents.

Prints With Rubber Balls

He studied walnuts. The rough, irregular shell would not be easy to brand. But of one thing he was sure, he would use the printing press as a model from which to make his branding-machine.

He decided that, instead of using a hard roll for the actual printing, he would stud the press with soft rubber balls. Thus, as each ball pressed against its corresponding walnut, the ink on the ball would reach all the high and low spots on the walnut's shell.

He arranged the balls around the

roll in seven rows of three each, and used a rotary feed drum that would hold nuts of all sizes. When his branding-machine was set in motion, ink was spread on the roll that bore the etched brand marks, and this ink was trans-

and quick-drying qualities for his purpose.

Then there was the question of heat. If the rolls became too hot the rubber balls would melt. So he attached a water-cooling system to the machine that kept everything running at a temperature of sixty-five degrees. All the while he worked on it, his curious neighbors would stand around and hold long dissertations on nuts in general. But he continued to plug away.

In the first place, he wanted that ten thousand. Then, his wife had told all the neighbors that he was going to win the prize. He simply had to win.

Just in Time

He worked day and night, and handed in his model a few minutes before the contest closed. There were one hundred and twenty-seven models in all. Most of them did not have proper cooling systems. Mr. Wysong won the prize.

He took a long, much-needed sleep, and then he immediately got busy on an orange-branding machine, which he subsequently also patented.

Now the money is rolling in. This summer he intends to visit the mine that caved in at the beginning of this story and see if he can cave it out again. There is a fine trout stream near the mine, and in his leisure moments

Mr. Wysong is going fishing.

"I've wanted to take a vacation and go fishing all my life," says he, "and now I'm going to do it. I've ceased being the 'poor relation' in our family, and hereafter A. S. Wysong is going to catch trout every year, even if he has to invent a new kind of hook to catch 'em with."



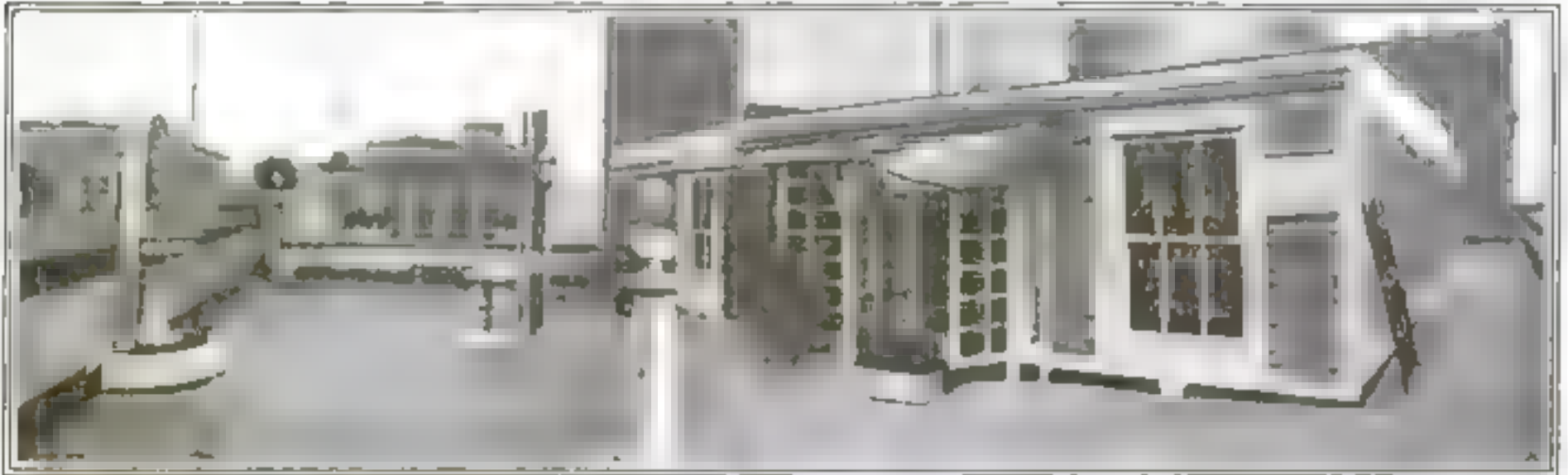
This is A. S. Wysong, who won a ten-thousand-dollar prize for inventing a walnut branding machine. He feeds walnuts to the machine three at a time and the brand is stamped on them by means of soft rubber balls that sink into all the crevices in the rough shells.

ferred to the rubber balls, and then to the nuts.

Mr. Wysong tells us that he had very little trouble getting together the mechanical parts of the machine. His difficulty lay in getting the proper ink. He experimented with a hundred different formulas before he found a mixture with the necessary lubricative

Things You Can Do with a Roof

How the great waste spaces atop our buildings can be made useful



You can do almost anything with a roof, as the pictures below show. Mr. Gompert, a New York architect,

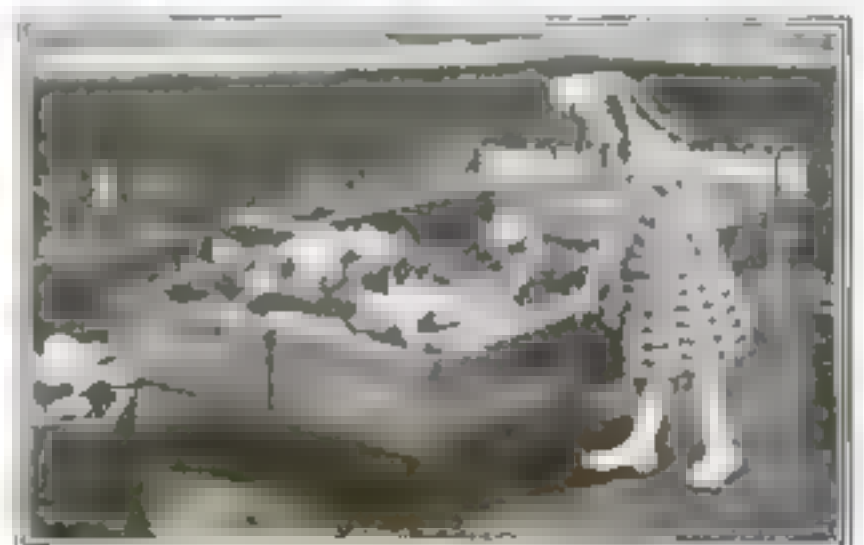
lives in a cottage on top of an office building. When the wind blows, we imagine he is well aware of it



Anita Surridge raises chickens on her roof. They are caught and sold and fly over the garden in the morning



Your roof may be turned into a hand-ball court if the people on the top floor don't object. But the players should be warned that a ball thrown over the fence is irrevocably lost



Anita wasn't satisfied with raising chickens, so she started raising cabbages in two feet of dirt. Seeds don't know the difference between a bed in the ground and a bed on the roof

Lightening the Burdens of a Bachelor

Electricity has saved many of them from desperate marriages



When your quarters need cleaning and polishing, Mr. Bachelor, do your own polishing with an electric motor having soft felt strapped to the drive-shaft



No matches to light the gas with? That's easy. Attach a knife sharpener to your gas valve and turn it on. You'll have your gas. Sparks? Not at all!



When your shoes need shining, get a good motor, wrap a felt polisher around the shaft and step on the switch



With an electric toaster and a paper at hand, nothing gets you into a jam. You can't get stuck with your own bread, first? Neither do dirty women



A wife and an electric fan on the same line of electricity. Fire will be the result of any accident

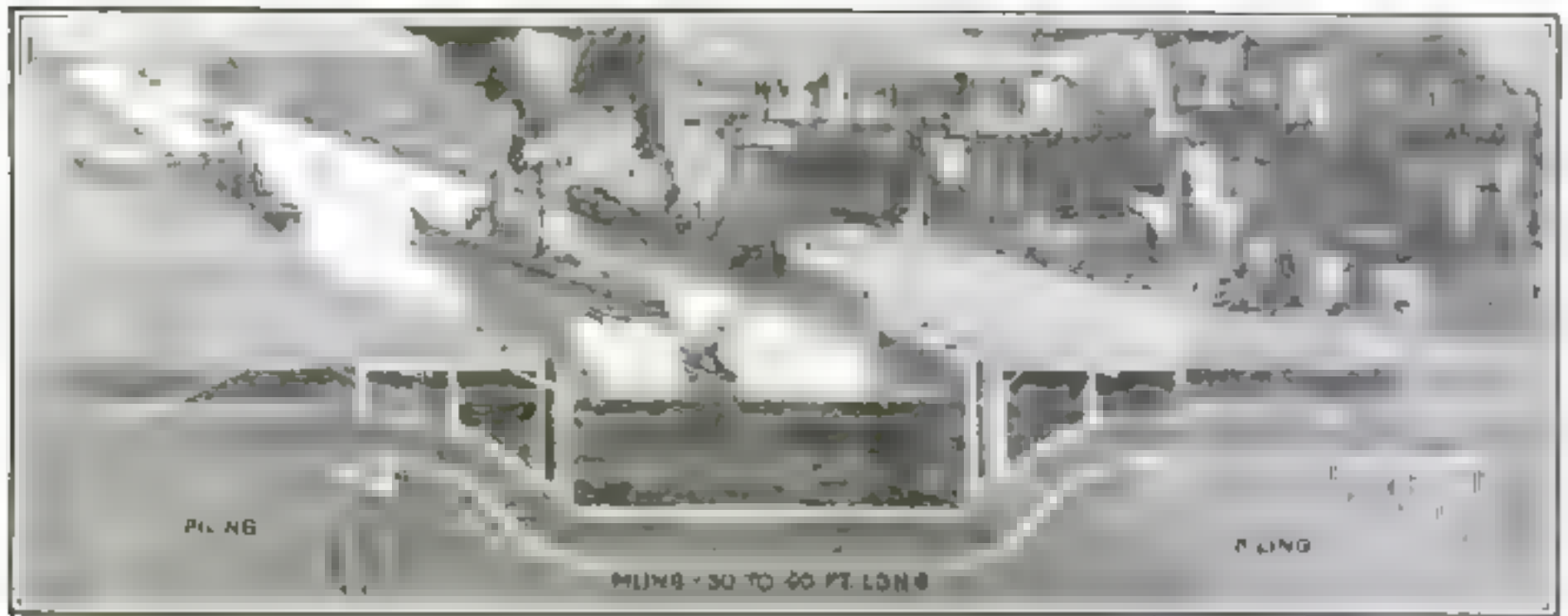


If you want a good electric fan, get a good one. A cheap one will not do you any good.

There is no need to be afraid of electricity. It is a safe and useful thing. It can be used in many ways. It can be used to light a room. It can be used to heat a room. It can be used to power a machine. It can be used to power a car. It can be used to power a plane. It can be used to power a ship. It can be used to power a city. It can be used to power a world.

Some people are afraid of electricity. They think it is dangerous. They think it is mysterious. They think it is magic. They think it is a force that they cannot control. They think it is a power that they cannot understand. They think it is a thing that they cannot use. They think it is a thing that they cannot live without.





How the lock of the Industrial Canal will look when completed. The elaborate series of gates, each weighing 200 tons, is shown also the emergency dam with the 300-horsepower crane to drop the sections across the lock

One Canal Dives Under Another

Building a ship-canal through treacherous quicksand beds

By Thomas Ewing Dabney

A SHIP-CANAL 30 feet deep and 300 feet wide is being built at New Orleans to connect the Mississippi River with Lake Ponchartrain. Twelve million dollars has been spent on it, and before it is finished, which should be within another year or eighteen months, it is probable that it will have cost twenty millions. Its purpose is to shorten the steamship distance between New Orleans and the Gulf, and to provide industrial sites on a fixed-level waterway, and also to develop an extension of the wharf facilities of New Orleans, wharfs being built on the canal at one quarter the cost on the river.

To carry out the plan, a soil problem never before encountered on such a scale had to be solved, and the greatest siphon in the United States built. Both achievements were marvels of engineering skill. To dig a canal through beds of quicksand, and to effect a crossing between a drainage canal and the ship-canal so that the drainage canal would actually go down under the latter and come up again, were problems seemingly hopeless to solve. Thus is how the difficulty will be surmounted.

Because of the difference in the level of the river and the lake, a lock must be built. This will be of steel and reinforced concrete. Designed to accommodate ships of 10,000 tons and drawing 30 feet of

water, the over-all dimensions of this lock are: length, 1,020 feet; width, 150 feet; height, 68 feet. The usable dimensions are 600 by 75 by 30 feet. The top of the lock will be 6 feet above the highest record stage of the Mississippi, and the floor will be laid 46 feet below the ground surface.

It requires a greater excavation than has ever been attempted in this region, underlain as it is by quicksands, which are forced into a cut by the pressure of the earth, the water pressure of the river and gulf, and the natural gas pressure. Many engineers said it could not be done.

George W. Goethals and Company, of New York, the engineers in charge of the work, began an excavation 750 feet wide by 1,500 feet long, gradually sloping the cut toward the center in an effort to prevent slides. Where the excavation began, a ring of sheet piling was driven to hold back the first stratum of quicksands. About 150 feet farther in, another ring of sheet piling was driven through the

second stratum of quicksands. Then Goethals started the delicate task of driving the center cut for the lock.

The pressure proved greater and the sands more liquid than had been anticipated. In May, 1919, the sides of the excavation began to cave in. The quicksands, running through the sheet piling as through a sieve, flowed in as fast as the dredge could pump them out; and the gas pressure threatened to blow through the bottom of the lock site.

Water to the depth of 30 feet was pumped into the excavation. Its weight counterbalanced the combined pressures. Then wells were driven to relieve the gas pressure; a ring of steel sheet piling was put down to hold back the quicksands, and braced apart by thousands of 10-inch timbers; on these the pile-drivers were erected, and drove the foundation piles in the water as deep as possible.

The water was then pumped out. This was done very gradually, while a corps of engineers and experts watched every timber.

Only one section of the side walls moved—about three inches. Then the braces caught. The flow of quicksands was stopped. The gas pressure was relieved.

These piles are now being followed down.

They are 60 feet long and there are 14,000 of them. An extraordinary foundation is needed to sustain the weight of the

"It Can't Be Done"

The sides of the excavation began to cave in, the quicksand rising through the sheet piling as through a sieve—and the gas pressure threatened to blow through the bottom of the lock site.

A hopeless job? That's what many engineers said, shaking their heads with the world-old "it-can't-be-done" motion. But there's always an industrial general with all the punch of a Foch or a Grant and all the strategy of a Napoleon. That's why the unending battle in which man pits himself against the forces of nature has gone steadily in man's favor.

When you read "One Canal Dives Under Another" it might be worth while to remember that, but for science, we should all of us still be living in caves and grubbing roots.

lock—225,000 tons when empty, or 350,000 tons when filled with water.

The floor will be 10 or 12 feet thick. It will be laid in 15-foot sections, for only a few of the braces can be removed at a time. The walls will be 13 feet thick at the bottom and 2 feet at the top. One hundred thousand yards of concrete will be used in the lock.

The ground will be sloped to the top of the lock wall on a 150-foot terrace, to brace the walls against the weight of water within. There will be huge anchor columns of concrete to hold the walls against the weight of earth when the lock is empty.

The lock will have five sets of gates, built of steel plates, 4½ feet thick and weighing 200 tons a gate. Four sets of these gates will be of the 55-foot size; one set of the 42-foot size. Each gate will be operated by a 52-horsepower motor. There will be an emergency dam, consisting of eight girders, 80 feet long, 3 feet wide, and 6 feet high, and weighing 80 tons each. A crane, operated by a 300-horsepower motor, will be able to drop them into slots in the lock walls, across the lock entrance, in an hour.

Two channels, each measuring 8 by 10 feet, cut into the base of the lock, will fill and empty it in twenty minutes. Openings will be controlled by eight sluice-gates, each operated by a 52-horsepower motor.

Six capstans, two at each end of the lock and two in the middle, will work ships in and out of the lock.



Looking into the excavation for the remarkable ship lock. Note the thousands of piles driven to sustain the weight of the 350,000 tons of concrete and steel. The excavation extends 40 feet below the tops of the piling.

Each capstan will be operated by a 52-horsepower motor, and will develop a pull of 35,000 pounds.

Concrete will be laid at an average rate of 400 yards a day, according to the estimate of engineers. Three railroad trestles are being built over the excavation to accommodate the concrete trains.

The concrete on this job will cost, laid, about \$2,225,000; the mechanical equipment, \$1,516,900. If the lock is to be finished by March, 1921, a force of 2,000 men will have to be employed continuously. Their pay-roll will be about \$2,500,000. Difficulty is being encountered in getting that number of properly qualified men together. According to present estimates, the total cost of the lock will be in the neighborhood of \$7,500,000.

The Industrial Canal crosses one of the city's drainage canals. This is the Florida Avenue canal, leading into Bayou Bienvenue. This rendered necessary the construction

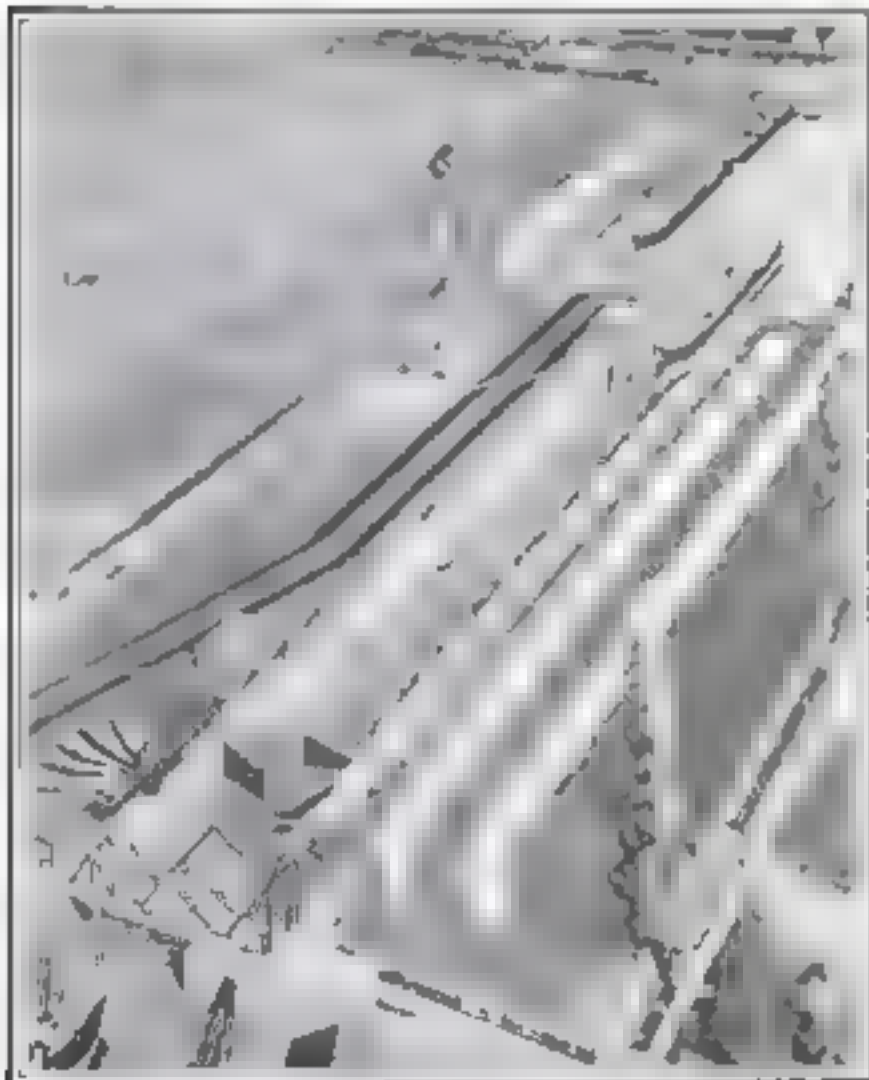
of the siphon—a concrete channel designed to carry the drainage canal beneath the ship-canal, and deliver it to the pumping station on the other side.

The siphon is 378 feet long; it is divided into four compartments: two storm-chambers measuring 10 by 13 feet each; one normal weather chamber measuring 4 by 10 feet; and a public utilities duct. The latter will house the water and gas mains, electric light cables, and telephone and telegraph wires. The storm-chambers handle the rainfall of cloudbursts. In ordinary weather the drainage is concentrated through the smaller chamber, and with the strong flow thus obtained the settling of sediment is reduced. The siphon has a capacity of 2,000 cubic feet of water a second.

There are eight sluice-gates, operated by hydraulic cylinders, to open and close the water-chambers. There are eight manholes, measuring 4 by 6 to 6 by 13 feet, to facilitate repairs.

It took eighteen months to build the siphon. The work presented many difficulties. First the Florida drainage canal had to be closed with two cofferdams. Inside them, the siphon construction began. There was much quicksand trouble. Pumps had to be operated continuously to keep the cut drained. At 46 feet below the ground-level, the foundation piles, from 30 to 60 feet in length and from 3 to 5 feet apart on centers, were driven.

The excavation, foundation, and other work of preparation for the siphon cost more than \$400,000. The concrete cost \$170,000. Machinery and incidentals cost \$50,000.



The largest siphon in the United States. The entire drainage of New Orleans is carried under the ship-canal. The cost of the siphon was \$630,000, its capacity is 2,000 cubic feet of water a second.

A Giant with the Touch of a Child

When it is properly guided and controlled, this machine is a magic worker

CAN you imagine a giant with hands so strong that he can put a head on a big rivet with a pressure of about 575,000 pounds to the square inch, and yet so gentle that he can crack the shell of an egg without crushing it? The machine shown in the accompanying illustration is just such a wonderful giant.

Look at the powerful pressure clamp, crooked like the monstrous hand of a giant, one end representing the fingers, the other the thumb. By hydraulic pressure this thumb—or, rather, the piston movable in the direction in which the thumb points—may be extended toward the tips of the giant fingers with scarcely an effort. So gentle and delicately progressive is this motion that you may even bend the shell of an egg in the giant's grasp without cracking the



This machine, controlled by one workman, will noiselessly head rivets with a pressure of 575,000 pounds to the square inch

brittle shell, if you stop the motion of the piston in time.

But let the motion of the piston continue, and mercilessly and with irresistible force it will crush everything

that comes between the relentless grasp of the giant hand. A white-hot iron rivet is placed between the extensible thumb and the fingertips of the giant, and in a few minutes the heated end is mushroomed and squeezed into the shape of a rivet head, all without noise or apparent effort.

The illustration shows how this giant hand, properly guided and controlled, is utilized in the metal industry for performing the most difficult tasks, requiring enormous power. The riveting-machine is suspended by chains from a traveling crane, and is placed in working position by an ingenious, yet simple, controlling mechanism. The distance between the working ends of the clamp is one foot, and the movable piston can be extended to a distance of about four inches.

Taking the Sting Out of the Bullet

NOW that the war is ended, what is to be done with the enormous quantities of unused ammunition left over in the military storehouses of every belligerent nation? This ammunition, useless in time of peace, represents an enormous value in copper, brass, lead, and steel, of which the shells, bullets, and caps of cartridges are made.

In Germany, which is in great need of copper, brass, and lead,—more so than any of the Allied nations,—a successful beginning has been made in reclaiming the metals contained in the left-over ammunition. The pic-

tures below illustrate the method employed for reclaiming the metals contained in infantry ammunition at one of the German plants.

A conveyor carries the loose cartridges, as they are taken from their packing-boxes, to an inclined, rotating iron cylinder heated by coke and oil to a sufficiently high temperature to cause the cartridges to explode while they are sliding down the cylinder. The discharged cartridge-shells then drop into a reservoir filled with water. From this tank the cartridges are carried by an elevator to a magnetic separator, which removes all iron or steel particles from the mass. In a perforated rotating drum, heated to red heat,

the lead is melted out. It drops through the perforations of the rotating cylinder and is collected in molds, leaving only the copper or brass shells and caps in the cylinder. The machinery of the entire plant is operated by a five-horsepower gas-engine and disposes daily of about 1,000,000 cartridges.

By this method of reclaiming the metals contained in ammunition, nothing is wasted but the powder charge and the small quantity of fulminate in the ignition-caps. To extract the charges of smokeless powder would cost more than the powder is worth.



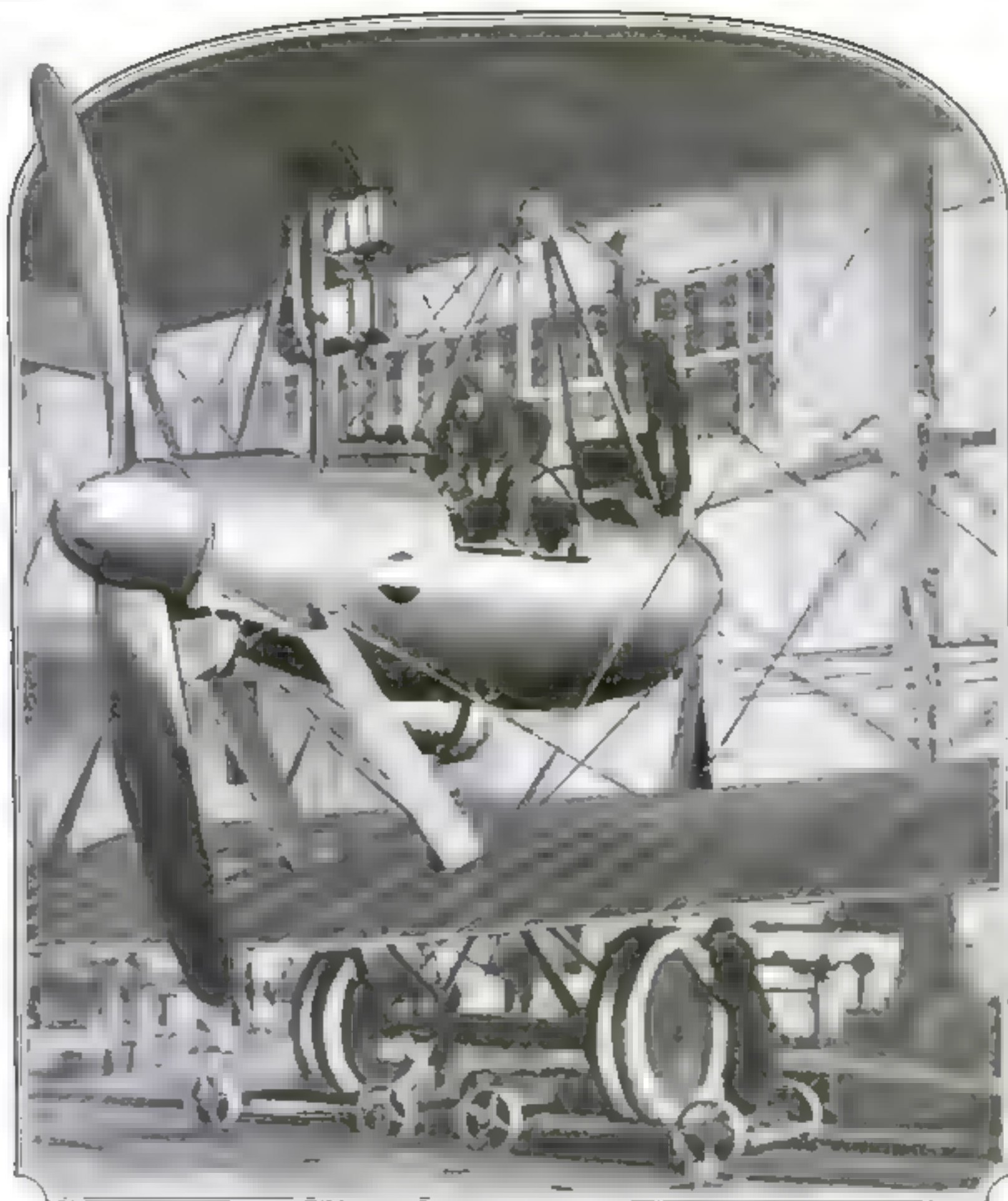
The heat of the rotating cylinder through which they slide causes the powder of the charge to explode



In this heated and rotating drum the metals are separated by melting out the lead of the bullets



The cartridges are unpacked and placed on the conveyor which takes them to the discharge drum



A New Giant of the Air

WHAT will be the size of the largest airplane that we can ever hope to build? What are the elements that limit the flight of heavier-than-air craft? The forces that operate upon the airplane in flight are dependent upon the size of the machine, its shape, the density and resistance of the air, and the wind pressure.

The first airplanes were almost mere box-kites with the pilot exposed to the full force of the wind and his body offering resistance to the motion of the craft through the air. Imagine an attempt at speed on water when one's boat is a square box that has projections sticking out from it offering resistance to the medium in which it moves. What would happen if a powerfully equipped engine were placed on such a boat to try to drive it at motor-boat speed? The force of the engine would probably smash the craft on which it had been placed if this craft were of such frail construction, comparatively speaking, as were the early types of airplane.

Following the hint given by the shape of certain birds and fish whose motion in air or water is smooth and swift, modern airplanes are constructed with serious regard to their stream lines. The flow of the air around them must be smooth and uninterrupted by awkward projections.

In the new giant Aviatik airplane recently given satisfactory tests in flight carrying twenty-two passengers with baggage, there are two advanced motors of 220 horsepower to pull the craft through the air, and two additional 500 horsepower engines in the rear to push. A gondola carrying one of these 500 horsepower engines is shown in the picture. Note also the huge wheels of the landing gear. Great tanks carry almost 2,000 gallons of fuel. The greatest attention is given to the stream-line construction, thus reducing the resistance offered to the air by the exposed parts of the framework. With a wing span of about 400 feet the Aviatik airplane is the largest in the world.



These monster elephants of the air are lined up for parade—they are kept in place by trucks and hundreds of soldiers holding ropes.

Elephants on Parade

YOU may think you have seen enough parades in the past year or so to last you a lifetime.

Ah, but when the elephants of the air parade, you get an entirely new set of thrills! The picture above shows one section of an "elephant" parade that took place recently at Arradia, Cal. The monster gas-bags were lined up side by side and held in place by individual motor-trucks on the ground and by hundreds of soldiers holding ropes.

When the parade began, the trucks moved forward slowly, so did the soldiers. The elephants moved with them, and the crowds near by enjoyed the spectacle.

A Snake Memento

THE snake cherishes its rattle and adds a new section to it each year. It carries its rattle high in the air to protect it from harm. But when there are ten sections to its rattle, the outside section usually wears off. Thus few snakes are found that have rattles of more than ten sections.

A man in western Kansas kept the rattles of all the snakes he killed and mounted them on a card in star formation.



These are the rattles from the various rattlesnakes that one brave Westerner killed; rattlers add one section a year to their rattles.

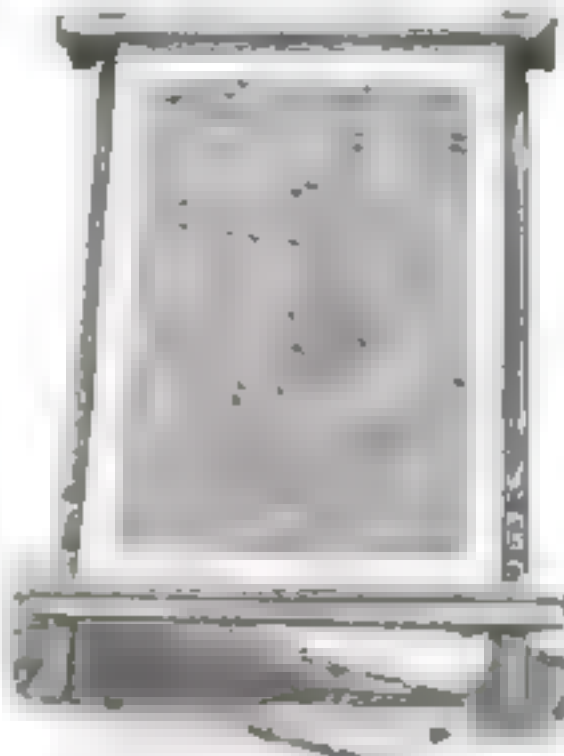


An eagle seen in Alaska. It measured seven feet nine inches from tip to tip. Hundreds of these monarchs of the air can be seen in the great icy fjords of Alaska.

A Feathered Robber Baron of the Air

THIS feathered monarch of the great Alaskan forests was shot near Wrangell, and measured from the tip of one wing to the tip of the other seven feet nine inches. It is not unusual, when sailing among the fjords of Alaska, to see hundreds of these winged autocrats consorting, in really frivolous moods, among the debris along the shore, or screaming among the great forest giants that hold their nests.

The eagle has ever been a symbol of power, imperious arrogance, and despotism. It is the last emblem, from that viewpoint, that should represent the ideals of democracy, under a republican form of government. But the eagle inspires also the idea of freedom, and of that it is a fitting emblem.



A holder for preventing the fly-paper from being blown about by the wind and doing damage.

Making the Fly-Paper Stick to Business

A NEW JERSEY man has invented a device to keep fly-paper in one position and from being blown by the wind on to Father's favorite chair or Mother's most treasured lace curtains. It consists of a frame having grooves at each end to permit the insertion of the sheet of fly-paper. A narrow strip of wood is forced down into the groove over the paper to hold it taut. At the lower end of the frame three grooves are located for taking care of any variations in the lengths of the fly-paper.

When the fly-paper is in its frame, it may be placed up in any convenient place, and will be so conspicuous as to be readily seen before being sat upon. In addition to being useful as a holder for fly-paper, the device can be used as an embroidery-frame or as a stretcher for cloth or paper.

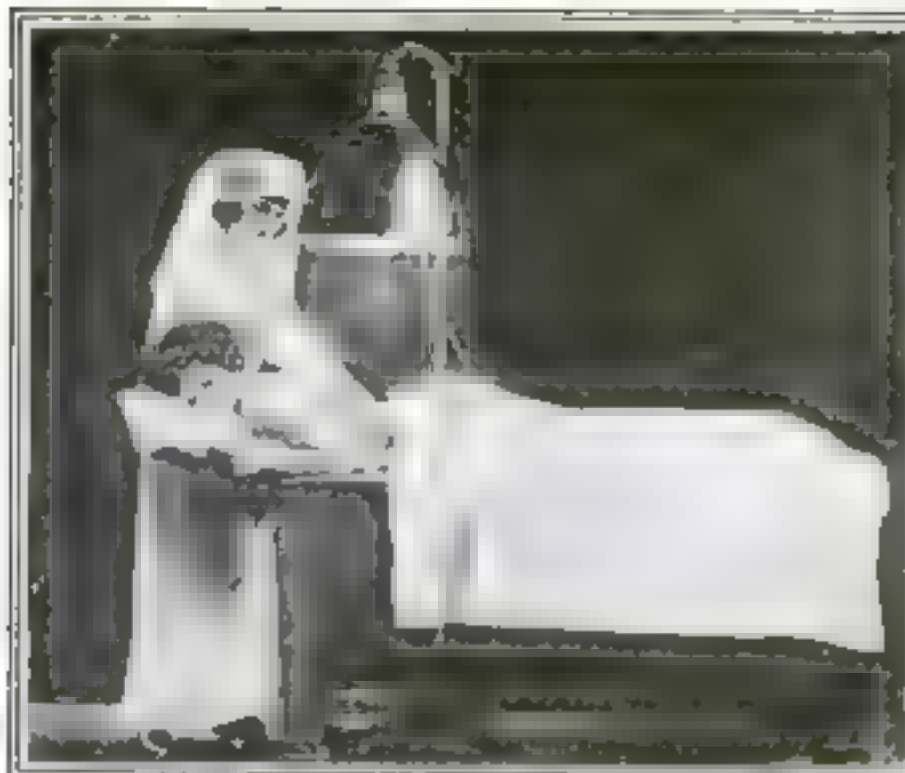
The Eel and the Tortoise

YOU know the tale of the hare and the tortoise. Now hearken to the tale of the eel and the tortoise. Both of them were taking life easy hundreds of years ago, when a sudden flood, carrying wood, mud, and stones with it, overwhelmed them. The eel was wrapped around the turtle's legs when they were trying to find shelter, and both of them were killed.

How do we know this story? Because their bodies became fossilized, and were recently found in one of the many fossil-beds of Oklahoma.



The eel and the tortoise died together hundreds of years ago, presumably in a devastating flood; their bodies were turned to stone.



The rays from a powerful light inside this reflector penetrate the patient's skin and stimulate the blood-cells.

Fighting Disease with Light Rays

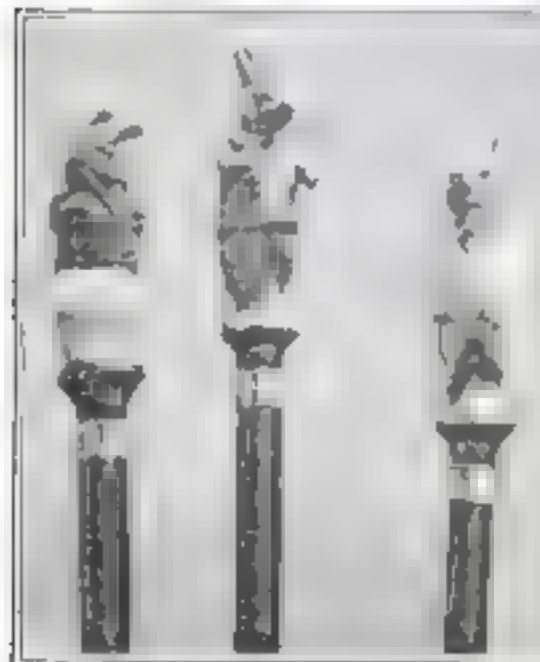
H EAT and light, it has been found will help cure many ills. They stimulate both the red and the white blood-cells, causing the cells to put up an active fight against disease germs. In many hospitals powerful electric lamps are placed inside reflectors and the piercing rays are used for treating Bright's disease, rheumatism, influenza, and pneumonia.

Pneumonia, especially, is a disease that a patient must fight by himself. And the condition of the blood is a deciding factor. The blood fights the poison, and, if it is in good condition, checks the infection.

Fashions in Canes

F O R a long time men have sat back and let the women wear all the gaudy clothes and carry the beaded bags and fluffy dogs. But now the men have started. Not long ago we saw for the first time brilliant satin lining peeping out of their new bell-shaped cuffs.

And now men's canes have lost their dignity. Pup-pies and baby bunnies are carved on their knobs. And the dear creatures sit up and beg in the most touching manner.



Puppies, pussy-cats, and bunnies carved on the knobs of canes. Are men too having fads now?



It snowed powder-puffs in this drug-store window. There are large ones, small ones, cheap ones, dear ones.

The House Built of Powder-Puffs

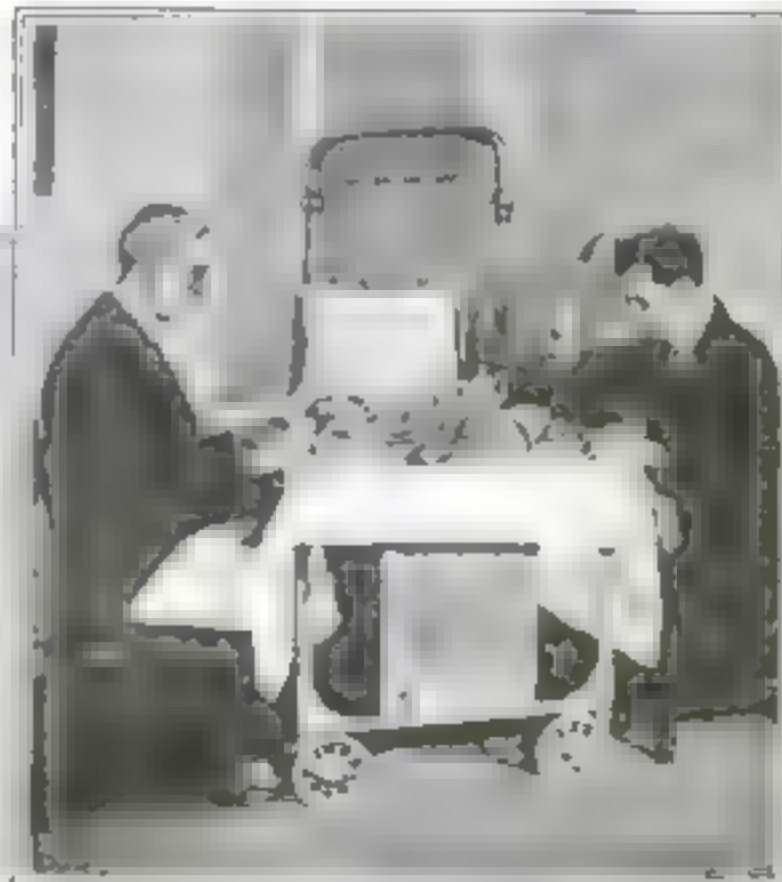
N O home is complete without a powder puff, but there is such a thing as too many powder-puffs. Here is a house that is literally covered with them—ten-cent puffs, fifteen-cent ones, quarter ones, and even thirty-five-cent ones hanging all over the walls. Some of them are wool puffs, others velvet.

What's the idea? Advertisement. The druggist in whose show-window the puffy house was built had so many powder-puffs he didn't know what to do—until the idea of the puff house struck him.

The Breakfast that Won't Get Cold

A L M O S T as good as breakfast in bed is breakfast directly alongside your bed. Many hotels are now furnishing this near-home comfort. You order your breakfast, and shortly after a waiter wheels a serving-table into your room, and departs.

The top of the table is properly set, and beneath it is an oven in which your breakfast waits. It will wait just as long as you want it to, and when you take it out it will be hot. Beneath the oven there is a small drawer holding a red-hot brick. The shelves of the oven are perforated and the heat from the brick rises.



The waiter wheels your breakfast in and departs. The top of the table is set and the food is in the oven beneath, where it is kept hot by a brick.

Stockings Come High!

L O O K out when you buy silk stockings and be sure you ask the price first. If not you may sustain an almost total loss of one hundred dollars.

That's what they are charging for stockings in some shops on Broadway, New York. True, one hundred dollars doesn't buy much these days; but at least you can get three times for your Ford for that amount, or buy your old shoes enough inner tubes to last for five years.



The cost of high living has a striking illustration in this hundred dollar pair of stockings.

Place the work on the table, turn the table to a convenient position, lock it, and proceed with the work.



Turn the Table and Lock It

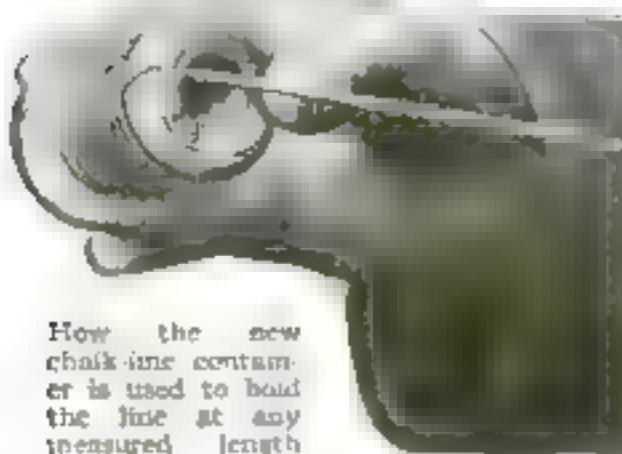
A WORK TABLE that locks in thirty-six different positions, and which rotates on ball bearings, is indeed a very valuable accessory in the machine-shop. Any work that one may be engaged in, whether it be welding or merely the assembling of small parts, can be handled efficiently with this table.

Instead of having to move the heavy object that is being manipulated on the table, to place it in convenient positions, it is secured to the table and the table turned on the ball bearings to the desired position, and locked. The locking device may be managed by a foot-pedal on the floor attached to the upright support of the table. For welding, the table is a valuable time-saver.

The Line Doesn't Tangle in This Container

"WHAT a tangle!" And the carpenter reaches into his tool-box to untangle the chalk-line from his tools.

That was the old way. The new way is to use the clever chalk-line container invented by Mr. Frank G. Pierce and Mr. Charles M. Propst, of Marshalltown, Iowa. It consists of a spool and a metal strip at the end of the spool under which the chalk-line is slid when it is desired to measure off a length of the line.



How the new chalk-line container is used to hold the line at any measured length.



A smaller table, which is made to rest upon the work bench, also locks.

It may be made into a paper-hang, or a bench, or a painter's scaffold.



The picture on the left shows the wood fibers of the rail tie torn and compressed by the old railroad spike. The new spike, shown on the right, has a twisted, fluted shank which bores its way into the wood. Its holding power is 42 per cent greater in both hard and soft wood.

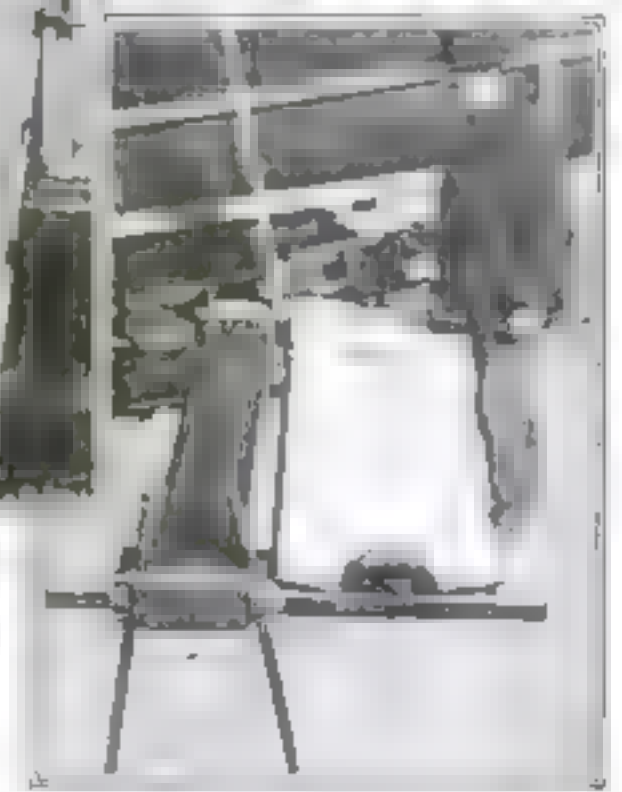
The Importance of Railroad Tie Spikes

WHEN the train runs smoothly along the rails no one thinks about the track and how important are such details as the spikes that hold the rails to the ties.

Walk casually along a seldom used railroad switching branch. Look down at the rolling ties and see how the spikes seem to be so loosely embedded in the wood that one could almost pull them out by hand. Why is the holding power of the spikes so impaired? The Civil Engineering Testing Laboratories of Columbia University, New York city, can answer the question, because a thorough test of the holding power of railroad spikes has been made there.

When a spike is driven into a tie, the wood is forced downward and the fibers are pressed outward. A new type of spike has been devised which bores its way into the wood as it is driven in. The holding power of spikes is determined by the amount of surface in contact with the wood and by the condition of the wood fibers. The new spike has 25 per cent greater surface area than the old spike, and it is fluted so that it compresses rather than crushes the wood fibers.

A painter's trestle that can be easily folded into a small compass for carrying from place to place.



A Folding Trestle for the House-Painter

A BUNDLE of cords, then, stretched into a table or a platform, a trestle or a painter's swing bridge or a scaffold.

A patent granted to Mr. Alvin Leonard, of New York, has introduced a new and useful device to paper-hangers and painters. It is a folding trestle which may be used as a step-ladder, or as a platform, or as a swing bridge. Mr. Leonard made it because he found that he needed something more convenient to carry than a step-ladder and planks for a painter's trestle.

He used it in his work as painter and paper-hanger; his fellow workers discovered that it would serve for anything, from a table or a bench, to a "swing bridge."

Two Eggs that Grew as One

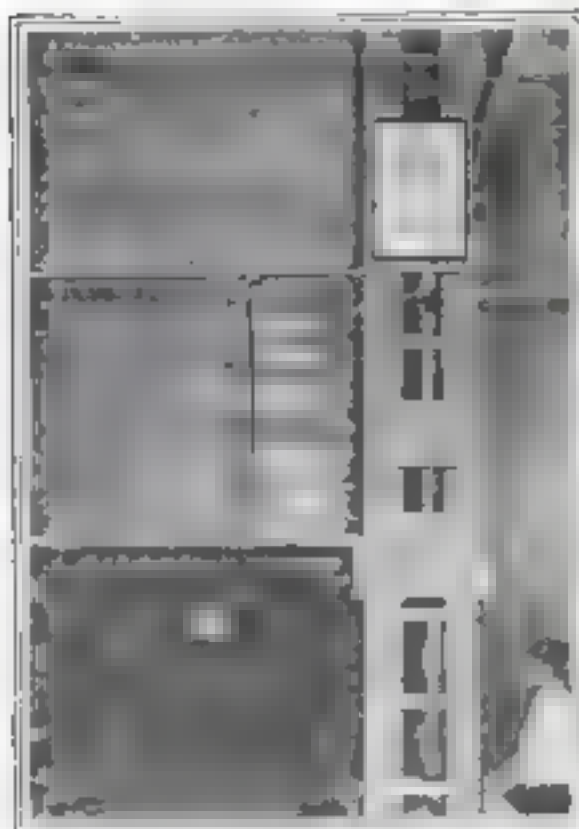
EGGS of the kind shown below are not of unusual occurrence, according to poultry experts. Various kinds of freak eggs, sometimes one egg within another, sometimes two yolks, sometimes two eggs attached end to end, are reported.

Some disorder in the egg-making process is held responsible. For example, the shell-making substance begins to do its work while another yolk is forming.



An egg that has one shell inside the other. Such freaks are due to a disorder in the egg-making process within the hen.

Rewards for Cleanliness Bring Quick Results



A tannery that offers prizes for cleanliness. On the blackboard the winners are recorded regularly.

"WELL! Here's a chance to win a prize," the workers in a big plant reflected a dozen times each day. As they thought about it, they set to work cleaning up their department.

Posted on a blackboard in a large tannery is a list of the winners of prizes for cleanliness in the various departments. The idea of rewarding workers for keeping their departments in extra-fine order proved entirely satisfactory, and resulted in a tannery that is ready to bear scrutiny all the time.

A Doll's House Equipped for the Queen of Dolls

FOR five years Albert Langley of Cambridge, Mass., has worked on the doll's house shown in the picture. It is complete to the minutest detail. All the rooms are papered, varnished, and equipped with electric lights. A parlor, dining-room, kitchen, pantry, laundry, and reception-hall occupy the first floor; bedrooms and bath, the second. There are shades and curtains to all the windows.



Five years of spare moments were needed for building this minutely perfect doll's house. Every room is completely equipped.



A flytrap useful where flies gather here. An electrically driven.

Fanning Flies to Destruction in an Ingenious Trap

THE air smells good around here," says Mr. Fly as he begins to circle around the entrance to a remarkable fly trap invented by Mr. Harry Pakeman, of Columbus, Ohio. The fact that the air near the trap is permeated with the odor of the bait is the curious result of an early experiment of the inventor. He made a trap which consisted of a fan, rotated by a motor and producing suction strong enough to draw the flies into a net bag at the back of the trap. This resulted in a fairly good catch of flies. But after the first victims were safe in the trap the other flies in the room gathered around the net bag, apparently much interested in the fate of their brothers. They were thus at the wrong end of the trap to be caught.

The real reason for this conduct on the part of the flies was not curiosity. It was the enticing odor of the bait blown out into the air through the net bag. This gave the inventor a tip, and in his improved flytrap he has arranged the rotating fan so that the suction compartment or entrance to the trap is just above the bag of victims. Now the inquisitive flies that come make a long stay.

Shoe-Shines Free! How One Cobbler Attracts Patrons



One shoe-repair man has drawn trade by a free shoe shining device before his shop.

STEP up to the front of a shoe-repair shop and get a free shine. Into a little window at the bottom of the counter the dusty shoes are placed, and the brushes quickly do their best to shine them up.

While the revolving shoe-brush is polishing your shoes it inspires a warm feeling for the enterprising repair-man who installed it, and if you need to have any repairing done, you conclude that he is just the man to do it. Hundreds of people come every day to the shop, and are held by this artful device.

Argentina That's the Place to Travel In

IF, instead of returning all the railroads to their original owners, the government had handed them over to the Argentine Railroad Company, how happy we would be! This Argentine company gives its passengers real food to eat and real drinks to drink. What is more, there is a piano at the end of each dining-car. Music, wine, good food—what could mortal wish for more?



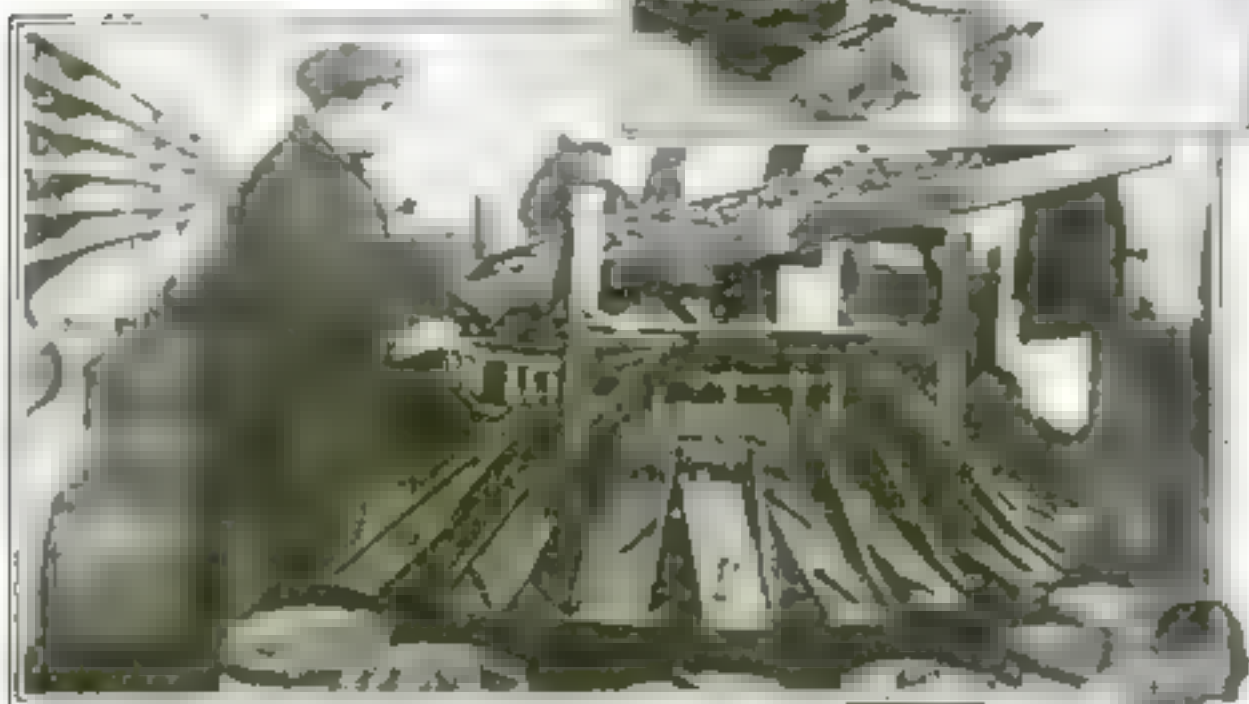
There is a piano in each dining-car on the Argentine Railroad. Music and wine with your meals.

Making Bamboo Needles for Talking-Machines



This machine
splits the spot
bamboo strips
into needles
at the rate of
10,000 needles an hour

The sections of bamboo are split at
the rate of 10,000 needles an hour



The sections of bamboo are split at
the rate of 10,000 needles an hour

How Money Can Be Made From the Scrap-Pile

THERE is a scrap-pile in every ship yard and in the vicinity of steel-plant, from which rivets and bolts can be made. The scrap-pile is a mass of steel, iron and other materials, which are cut up into small pieces. These pieces are then melted in a furnace and cast into the shape of rivets and bolts. This process is called the scrap-pile method. It is a very profitable method of making rivets and bolts, and it is the only method of making them that is so profitable.

Under the old method men had to measure the bolts by hand, and at best could assort only about 12 kegs in a 12-hour day. Two men can do this by machine at the rate of 7,500 rivets an hour, or about 100 kegs a day, with a saving of \$6.34 a ton.

In a power-driven assembling machine the bolts are threaded quickly. When a bolt is placed in position, a slight pressure of the workman's foot on a lever, imparts a forward or a reverse motion as desired. Of the bolts and rivets in the scrap-pile 90 per cent. need only a cleaning up of the burred threads, and this is accomplished by the machine satisfactorily, reducing by 85 per cent. the power required under other methods with a total saving of \$6.72.

He gets all the
benefit
without
moving forward



Even Your Running You Can Now Do by Machinery

RUNNING is very good for the health, but in these days of crowded cities a man can't run very far without having a policeman run after him and grab him by the shoulder: it looks suspicious.

You can have your daily run, however, if you get one of the new running-machines shown here. Instead of moving forward at each step you take, you remain in the same spot. The pathway slides backward on steel tracks located at the ends of the running-machine. The man who is shown in the picture using the machine is Jack Cooper, a well known trainer.

CURIOUS, isn't it, that the soft, sweet sounds of Galli-Curci's voice can come to the ear through the fibers of a bamboo phonograph-needle! These needles are made by machinery.

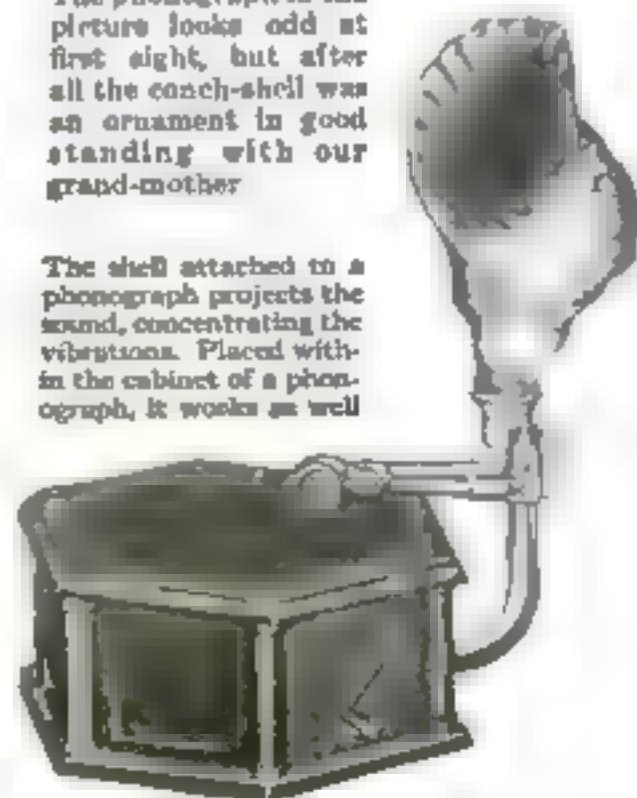
The tall canes from the bamboo thicket are cut into sections and selected carefully before being sent to the factory to be made into needles. Attention is given to keeping the enameled outside surface of the bamboo intact to make the hardened point of the needle. By machine the sections of bamboo are split into 10,000 needles an hour. Then each needle is pointed by hand. The prism-shaped pieces are inserted in a triangular bushing on a cutting-machine and a perfect point is obtained by running out to the cortex side of the bamboo. These machines turn out thirty thousand needles a day.

Listen to the Sea-Shell on Your Phonograph

A NOVEL way of listening to the music or spoken words of a phonograph has been developed with the aid of a conch-shell. The large open end of the shell serves as a projector of the sound-waves: here waves of music instead of the waves of the sea. The small end of the shell is attached to the phonograph. It may be attached as a horn would be, on the outside of the mechanism, or it may be placed within the body of the cabinet to project the sound through the usual outlet.

When one holds a conch-shell to his ear, what does he hear? The familiar saying is that he listens to the waves of the sea rolling and breaking upon the glistening beach; and it is true that the sound calls up before his mind's eye some such picture, the more vividly that he knows the source whence the shell has come. But in reality he hears only the faint outside sounds that are caught by the peculiar shape of the shell sounding-board and concentrated in his ear. This device of Nature for gathering the sound combines satisfactorily with the vibrating apparatus of the talking-machine. The sound-board of the shell catches the vibrations and faithfully reproduces them. The phonograph in the picture looks odd at first sight, but after all the conch-shell was an ornament in good standing with our grand-mother.

The shell attached to a
phonograph projects the
sound, concentrating the
vibrations. Placed with-
in the cabinet of a pho-
nograph, it works as well



More Speed from the Pedals of Your Bicycle if You Use 'his Weird Model

WITH its frame extended in the rear supporting a sprocket-wheel that is connected by a chain to a smaller geared wheel, a new type of bicycle makes its appearance.

The pedals are attached to two levers. These are pivoted to the frame, and as the bicycle is propelled, they work criss-cross, somewhat like a pair of huge scissors. A stout steel pin secured to the sprocket-wheel works backward and forward in a slot in each lever, as the pedals at the other end of the levers are worked up and down. This motion revolves the sprocket-wheel, operates the chain, and turns the rear wheel.

The bicycle rider has the satisfaction of keeping the dirty grease of the chain and sprocket-wheel far in the rear. The device provides different speeds, and can be adapted to drive other mechanisms than that of a bicycle.

A new arrangement for driving a bicycle, having the transmission-gear placed behind the rear wheel. This patented device can be arranged to furnish different speeds.



Use Your Canoe for an Umbrella When It Rains

THE watertight hull of the canoe can be used to advantage on dry land as well as in the water and it acts as efficiently in keeping out water from above as from below. When dusk approaches and the sky lets out raindrops instead of stars, the canoeist can lift his craft out of the water and make use of it as a tent. Canvas, cot and supporting poles are folded and tucked into the bottom of the canoe. Held in place by a pair of bars pivotally connected, are the supports that can readily be taken out and set up to carry the canoe. The bottom of the frail craft becomes the main support for the canvas of the tent. The canvas is thrown over the hull and staked down, or it can merely be thrown over one side, forming a "lean-to."

To afford shelter for a folding cot the canoe is turned upside down, and one end of it is raised from the ground until it rests upon the supporting-standards. A cross-bar connects the standards at a suitable height. The canoe-tent is the invention of Mr. Ralph Douglas George, of Kansas City, and to him the belated canoeist will return fervent thanks when a shower comes up, if he has been wise enough to provide himself with the apparatus described. It adds very little to the weight of a canoe.



A rubber ball around the hen's leg takes her mind off the subject of setting.

To Keep the Hens from Setting at the Wrong Time

A DEVICE to prevent hens from setting when they should devote themselves to laying, has been invented by John J. Gottschalk, of Taunton, Mass. It consists of a hollow rubber ball with opposite star-shaped openings to allow the passage of the hen's leg through the ball.

The rubber will engage on opposite sides of the joint of one leg, and make any attempt at setting a thoroughly one-sided affair. The device, being of rubber and resilient is not sufficiently rigid to be likely to injure the hen in any way, even though it effectually prevents the bending of her leg.

One cannot but speculate upon the thoughts of the lady fowl who is thus handicapped from carrying out her heart's desire. It is rather rough on her, we frankly admit, and her reflections can scarcely be complimentary to man, but since the invention works to the good of humanity, the poor creature's personal preferences must needs be disregarded.

A Free Home With a Barbed-Wire Fence for the Owl

IN Arizona and New Mexico, where the giant cactus rises from 15 to 20 ft above the landscape, the elf owl is found. This little bird is the "vest-pocket edition" of the owl family and is hardly larger than a sparrow, being only from 5 to 6 in. long. Its color is gray or brown and its specialty consists in making its home in abandoned woodpecker-holes in the giant cactus.

The owl roosts in these holes throughout the year. During the egg-laying season, the mother bird deposits her eggs in the holes without going to the trouble of making a nest. Since the woodpecker-holes are usually well up on the trunk, little danger can come from below, and the stiff spines act as an additional guard against intruders. Should the woodpeckers return to their old homes there might be trouble, but they never do.

The food of this inconspicuous little desert-dweller consists of grasshoppers and bugs—a very modest diet. Interesting as the bird is, because of its shyness and its small size, only a few persons have ever seen it or know of its existence.



The abandoned woodpecker holes in a tall cactus are just what the elf owl wants for a nest.



Here is a canoe that carries along its tent-poles and itself becomes the chief support for the canvas.

Counting Miles on a Typewriter

ATTACH a cyclometer to your typewriter. The arrangement is merely an adaptation of an ordinary cyclometer. It counts words by the mile.

A metal bar can be soldered to the space-bar of one's typewriter and fixed so that it extends far enough to engage the cog-wheel of the cyclometer. Allowing one touch of the space-bar as a true division between words, it takes just so many depressions of the bar to cause the cog to make one revolution. The cyclometer is firmly fixed to the same base as that which supports the

typewriter, and it registers one column in tenths of miles. Counting the number of words necessary to make a tenth of a mile and calculating ahead, it is found that there are 750 words in every mile.

A space must be made at the end of each line or allowance should be made and the number of lines counted as words, and added to the registered number. A cog-wheel can be soldered to any form of rotary counter. If one needs his cyclometer on the bicycle or the automobile, and if the spacing between words is truly recorded, the number of words can be quickly read.

Authors who measure their output in thousands of words may figure instead how



A clever adaptation of a cyclometer attached to the extended space-bar of a typewriter measures words by the mile and suggests long-distance typing races.

many miles they accomplish each year. Reckoning twenty-five words to a foot, the author may refer to a new one-mile novel he is contemplating, while he dashes off a little story less than $\frac{1}{4}$ mile long, and a yard or two of verse. The device also opens possibilities of typewriting races by the mile.



An Indiana farmer giving his wheat a bath. The seeds are placed in a cylindrical tank which revolves in a wooden tub filled with hot water.

IF wheat seeds are given a hot, steaming bath before they are sown, they will grow into healthier stalks. Smut and similar wheat diseases, which often ruin as much as a quarter of the wheat crop, will be washed away.

Giving wheat seeds their bath, however, has always been a slow process. But Russell East, of Indiana, has recently invented a bathing device that will clean as much as one hundred bushels a day.

The first step is to soak the seeds in cold water for about three hours. Then they are dumped into a cylindrical tank that is covered with wire screening. The next step is to lower the tank into a wooden bath-tub

that is filled with water having a temperature of 120° F. The tank is revolved for a minute and then withdrawn. Steam is forced into the water, pushing the temperature up to 129°. Then the wheat is given a second bath that lasts for ten minutes. When the seeds are removed and dried they will be absolutely pure.

A chain hoist and track take care of the raising and lowering of the cylinder, and the steam is piped from a traction engine.

Smut and other diseases that wheat is heir to, are washed away by this process, and the wheat goes into the ground in a healthy condition, to grow up strong and well, a comfort to the farmer.

Taking Kinks Out of Street-Car Tracks

RAILS that have been used under heavy traffic conditions for some time without having been smoothed by regrounding will make riding in a street-car quite as exciting as will a flat wheel on the car. All rails become rough in spots through the grinding effect of the wheels in starting and stopping the cars, and must be reground at regular intervals to avoid discomfort to trolley patrons and injury to the rolling stock.

Formerly the rails were reground by a

simple grinding tool operated by two men sitting facing each other on low benches over the rail and pushing the grinder back and forth by hand, as shown in one of the accompanying pictures. The other picture illustrates one of the modern electric rail-grinders used with success on many large European street railway systems.

The motor which operates the grinder, and which receives its current from the overhead wires or a storage battery, is enclosed in a hooded box mounted on

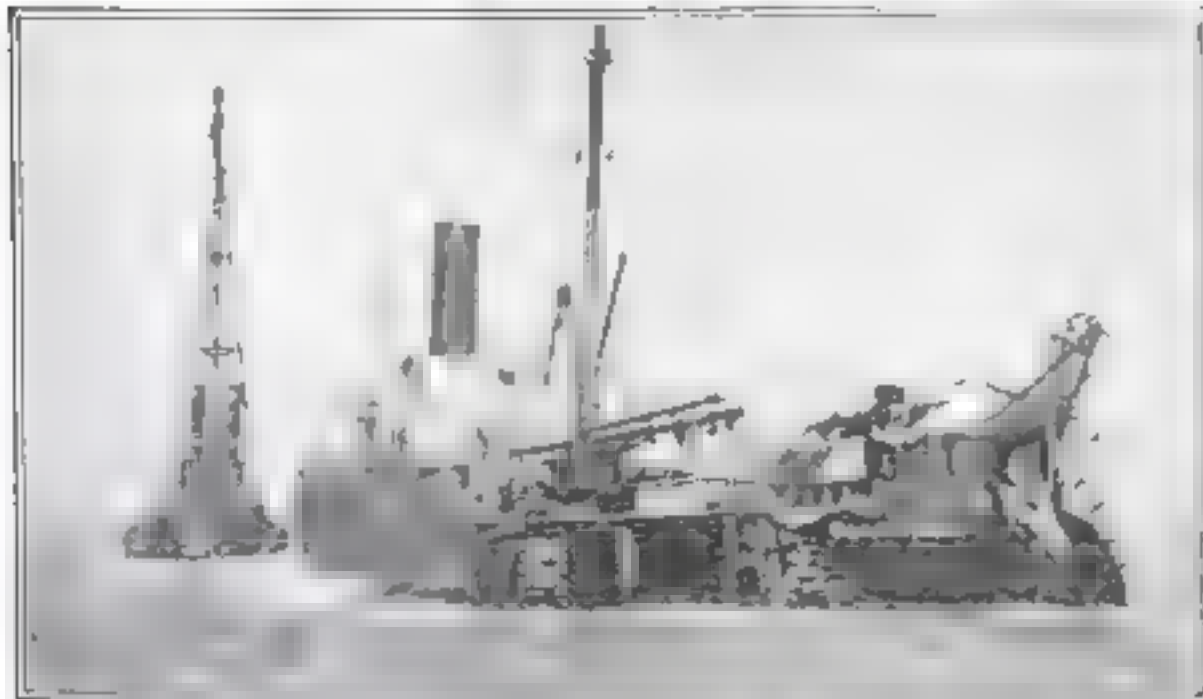
wheels. The grinding tools are suspended by chains from a pole at one end of the car, while the other end is weighted with sand-boxes and provided with a rack-and-pinion mechanism by means of which that end may quickly be raised, thus lifting the wheels off the ground. The electric rail-grinder accomplishes work that formerly required the efforts of two men, and does it in less time. Also, this grinder never gets tired of its job and the monotony of removing kinks does not concern it.



Formerly rails were reground with a hand-operated tool. The modern electrically driven grinder, pictured on the right, does the same amount of work in one-fifth of the time.



Cutting through Steel Ship Plates Under Water



The steamship *Lord Dufferin*, after having 65 feet of her stern cut away, was beached off the Statue of Liberty. The under-water arc-cutter was used in salvage operations.

THERE are sunken steel ships not too deeply submerged to be salvaged at a profit. In attempting the task of salvaging vessels of massive structure must be manipulated in mechanical ways that vary in almost every instance. The methods employed to lift one ship may not be suitable for raising another. But in nearly every case, especially where pumps must be put in below the water and where cutting and welding must be done, the cutting of steel under water is a difficulty. In the past dynamite has occasionally been used but it has always proved ineffective and, destructive.

A useful tool for the salvage crew is a recently patented device which consists of a powerful arc through which flows a current of oxygen, employed for cutting metal plates under water. The electric current

raises the arc to an enormous degree of heat, so great that it will cut through a sheet of steel with the ease of a knife cutting through cardboard. The metal becomes a field of molten craters as the tip of the current-bearing electrode is passed across it. The arc itself is formed in the usual way, and when formed gives off an amount of heat which converts the surrounding water into steam so rapidly that the water is prevented from coming into contact with the arc center. Thus the temperature of the metal is not lowered by the water.

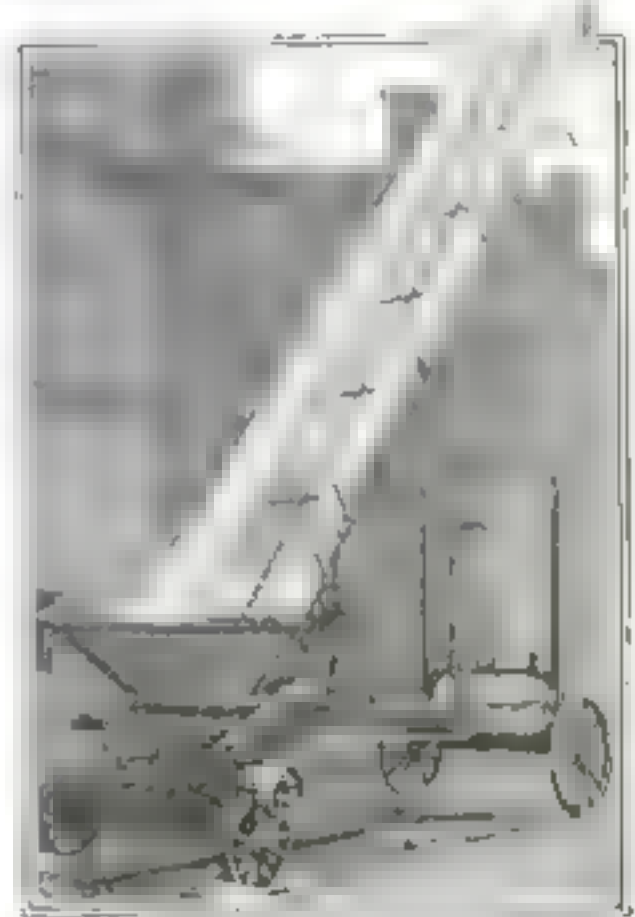
The under-water arc-cutter demonstrated its usefulness and value in the work of salvaging the steamship *Lord Dufferin* which was beached off the Statue of Liberty in New York harbor, after having sixty-five feet of her stern cut away. She

was in a sinking condition and partly submerged when the salvage work was undertaken.

The arc-cutter was employed for the submerged sections and was driven cleanly and quickly through the heavy plates. They were cut as evenly and accurately as those sections above the water. The surrounding surface of steel, which was heated to a condition of molten craters by the current-bearing electrode to facilitate the work of the arc-cutter, rapidly resumed its normal smoothness when the work was accomplished and the electrode removed.

Without this ingenious instrument it probably would have been necessary to employ dynamite in the salvage operations on the *Lord Dufferin*, and in consequence much valuable material would have been destroyed in the process of saving the reel.

This waste, once considered unavoidable, was entirely eliminated by the under water arc-cutter.



Pitchforks that carry hay from the ground to the loft.

The Great Junk-Heap of Panama

IN the thriving town of Balboa on the Pacific side of Panama, junk and scrap that has accumulated during the building of the canal is gathered, classified, and sold. There is a scrap dock eighty-two feet wide and five hundred feet long that has a capacity for fifteen thousand tons of scrap.

In the wasteful days before 1914, valuable

left-over pieces of iron, steel, copper, brass, and finished rail were dumped into the jungle. But since that time scrap gangs have gathered approximately three hundred thousand tons of junk.

A large percentage of this scrap is made up of obsolete construction equipment left by the French Canal Company years ago.



A great scrap dock has been built at Balboa at the Pacific end of the Panama Canal. Junk left from building the canal is sent there, classified, and sold.

Automatic Pitchforks

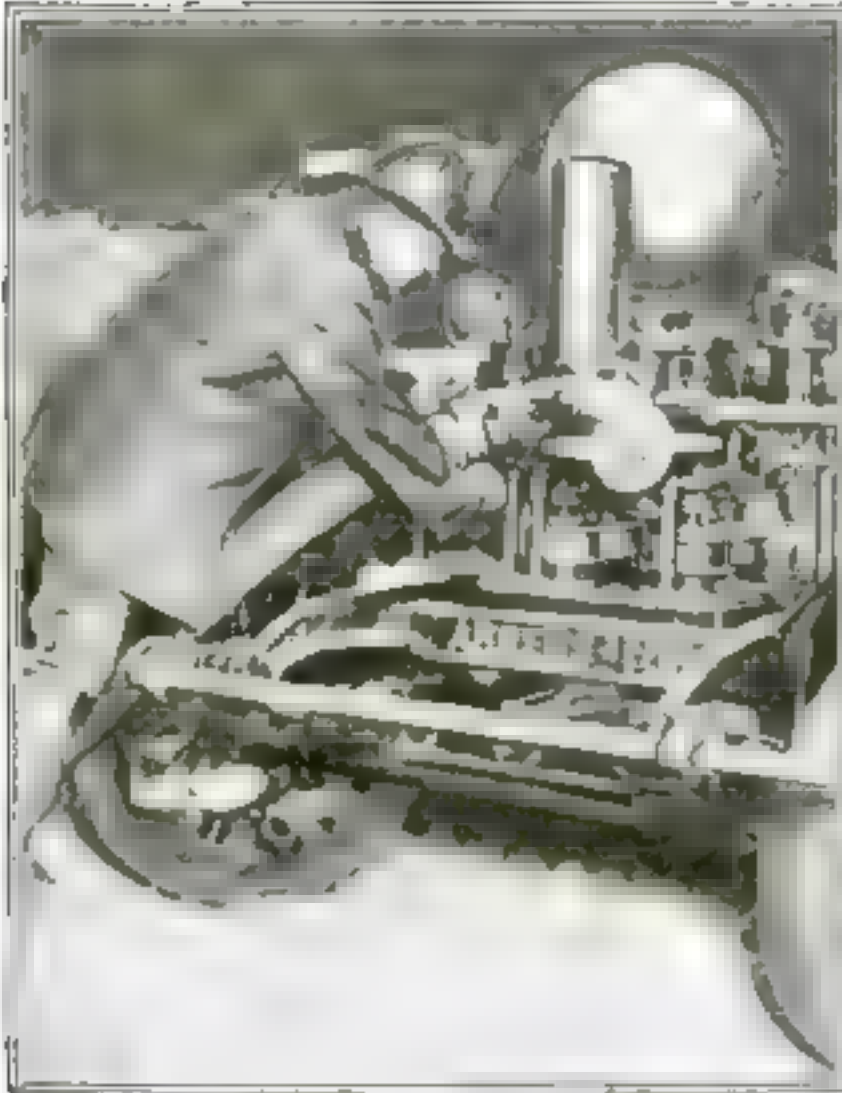
GETTING hay into the hay-loft is one of the farmer's problems. Farm helpers are scarce and, in consequence, high-priced. But there is a new machine that acts as a hay elevator, and requires but two men in attendance, one on the ground to do the loading and the other in the loft to rake off the hay when it arrives.

The elevating is done by a well spiked endless chain, like a series of pitchforks, that revolves around a trough. The trough, mounted on wheels, is raised to the required angle by a windlass before the chain is set in motion. The chain may be revolved either by a handle or by a pulley connected with an engine. When the hay is dumped in the bottom of the trough the spikes come along and carry it up to the top.

If front wheels of the wagon base are set at right angles to the wagon body they can be moved backward and forward in a wide semicircle.

Brawn versus Brains in

Society pays more for services of window-cleaners



Here is a man who must be an American citizen—must pass the civil service examination and acquire technical training for his work. It is necessary for him to be physically sound, and he is often called upon to tax his strength to the utmost. Moreover, in the performance of his duty it is frequently necessary for him to risk his life to save the lives and property of others. He is a hero in the eyes of the community. There is no doubt that he is a brave and courageous man. But his courage and his valor receive no acknowledgment from society which pays him to clean windows. The fireman, with his special physical training, receives only half the salary accorded the bricklayer. His pay is about \$10 a week



Not many of us think of the bookkeeper as all that important. He is a man who sits at a desk and keeps the books. He is a man who is not physically strong and who does not risk his life for others. He is a man who is not a hero in the eyes of the community. But the financial recognition accorded the bookkeeper is comparatively slight. If he receives \$40 a week he must be a good one



The men and women of to-morrow are being trained in the school-room to-day. There is no work more important to society than that of the teacher. His task is not an easy one, and requires years of education for it. The salary of the average teacher is about \$10 a week



The man who delivers the mail is a man who is not physically strong and who does not risk his life for others. He is a man who is not a hero in the eyes of the community. But the financial recognition accorded the mailman is comparatively slight. If he receives \$40 a week he must be a good one. The man who delivers the mail is a man who is not physically strong and who does not risk his life for others. He is a man who is not a hero in the eyes of the community. But the financial recognition accorded the mailman is comparatively slight. If he receives \$40 a week he must be a good one. The man who delivers the mail is a man who is not physically strong and who does not risk his life for others. He is a man who is not a hero in the eyes of the community. But the financial recognition accorded the mailman is comparatively slight. If he receives \$40 a week he must be a good one.

the Struggle for Existence

than for those of highly trained white-collar men

[illegible]

Here is a number of brown workers. The employer has even took a week. A worker took a rest of 9k. Under a new song for it and he is not able to speak of where an English language. He child can go to school to a \$20 a week teacher with education and training.



The pay of a printer ranges from \$36 a week to \$14 a day if overtime is counted. He does not need to exercise his brain to any great extent nor does he require much education. His job is a mechanical one that involves no danger like that of the fireman, nor is it so taxing as that of the bookkeeper.



Out-of-door sleeping is made comfortable by this canvas house built on a folding cot

Cabin and lens for concentrating sun rays on a patient's body. The invention of a French physician

A Room and Bed

ADVANTAGES of an enclosed sleeping porch with none of its drawbacks are provided by this invention with a canvas house built on a folding cot. The canvas is stretched over a light frame and buttoned at the sides and ends of the cot, so that the patient can lie down and the house can be raised up or put down in a few moments.

The sides of the cot house are provided with openings, netted to keep out mosquitoes and furnished with flaps that can be let down. There are also windows at each end. The cot is designed for use on open porches or on camping trips.



The blind man tells time by a watch on which raised knobs represent the hours

Harnessing the Sun's Rays

THAT the rays of the sun can be used for curing many skin diseases, and that sun baths are beneficial to those who are in perfect health is well known. The problem of utilizing this agency in northern countries where the hours of sunshine are few has been solved, he claims, by a Brittany doctor, M. J. de Tencac.

His invention consists of a revolving cabin sustained with a huge lens or lens system which concentrates the sun's rays on any part of the enclosed patient's body. This installation has just been tested in the neighborhood of Quimper, France.

Tongues Out!

WHAT a fine excuse these children have for sticking out their tongues! Their totem-pole does it, so why shouldn't they?

But you can readily see from the mischievous expressions on their faces that they are simply taking advantage of their religion. Extending the tongue is a religious rite among the Maori.

They are Polynesians. Tattooing is their specialty; sometimes they cover their entire bodies with elaborate designs.

Feeling What Time It Is

"LET me see what time it is," says the blind man, falling unconsciously into the speech of those with eyes. But what he actually does is feel the time.

He has a watch made especially for the blind. Instead of figures on the dial there are raised knobs, and the watch is so constructed that the owner can run his fingers over the face without damaging the hands.

One knob means one o'clock, and also four, seven, and ten o'clock; for the hours two, five, eight, and eleven there are two knobs, and for the hours three, six, nine, and twelve there are three knobs.

The Writing on the Rock

NO wonder the Chinese worship their ancestors! They are always coming across some great work that their ancestors did. At Amoy, for instance, are huge rocks covered with Chinese characters carved on them many centuries ago.

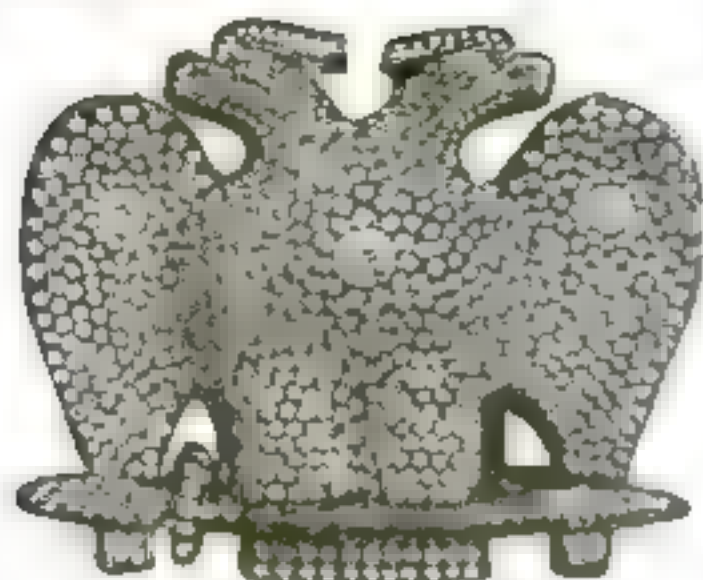
How did the honorable ancestors scale the sides of the rocks? What instruments did they carve with? Why did they do it?

The monstrous rocks covered with these carvings are larger than houses. The Chinese dwelling in the picture looks very small beside its towering neighbor.



Maori children enjoying a rite of their religion which calls for tongues out!

Hundreds of years ago these Chinese characters were carved on the great rocks of Amoy



Perhaps the most valuable bird in the world is this double eagle of diamonds

A Diamond Double Eagle

THERE are nine hundred and fourteen diamonds in the wings and body of the double eagle which represents the emblem of a Scottish Masonic order. It is valued at \$25,000, and its weight in diamonds is a little over one hundred and ten carats.

Forty-eight rubies glow in this amazing field of white brilliance which measures four and one half by five and one half inches.

Are We Going to Have Thirteen o'Clock?

"**A**RRIVING nine o'clock, Saturday," says the telegram. But there are two o'clocks in the day. It is now twelve o'clock. Why England is trying out a twenty-four hour clock in Greenwich. It will do away with the A. M.'s and P. M.'s.

Clock faces will be on order to commemorate the twenty-four hour marks and the usual Roman numerals will very likely disappear, Arabic numerals taking their places.

Whether thirteen o'clock will replace the day or night time one o'clock of today has not been announced.



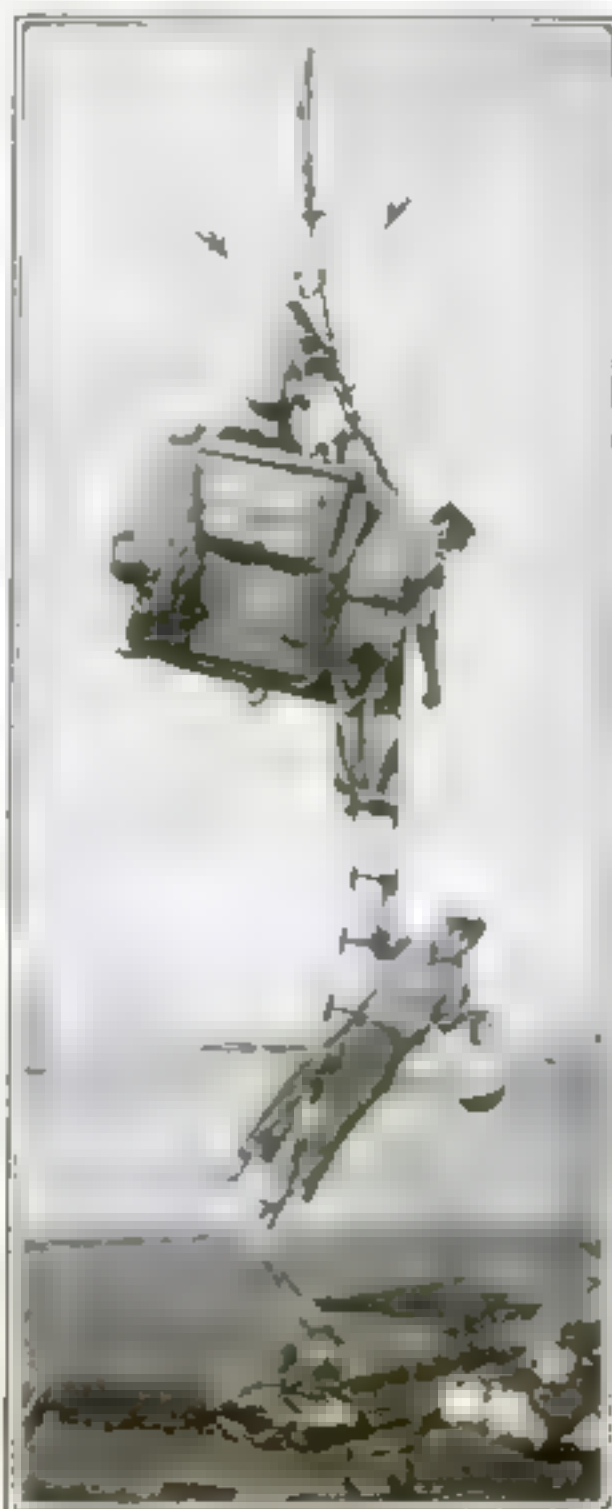
The twenty-four hour clock proposed by England will make our round a day

Our Midshipmen of the Air Sail High

WHAT a thrill, to swing at the end of a rope ladder, dangling at an altitude of a thousand feet in the air! When the balloon begins to rise the earth falls away below and the mountains of vapor overhead loom closer and larger. Objects on the ground or upon the sea become smaller, until finally the unaided eyefight cannot distinguish them. Then the men of the balloon corps take their marine glasses, cameras, or telescopes and bring the earth's details into better view.

When a number of free balloons are "let go" it is curious that they do not all travel together in the same direction. The explanation is that air currents are different at different levels. If one balloon rises higher than the others it may be caught in a current that will whisk it away in a totally different direction from its companions.

In a balloon race that started at St. Louis, Mo., one balloon traveled a distance of 1,050 miles; another went 920 miles, while a third reached only 360 miles from the starting point.



Dangling in the air from a rope ladder is sport for the midshipmen of the air



The dial enables the building engineer to calculate rapidly the weight or size of structural parts

It Measures Dimensions

THE rapid dial calculator is a handy instrument for the building engineer and others who would find quickly the results of figures in the building of standard forms for reinforcing. It enables one to find at once the depth of a concrete beam to carry a given load, or to find the size of concrete slabs and beams of different carrying capacities. It may also be used to find the thickness of wooden planks to carry certain loads, or to check the relative dimensions of wood or steel beams and slabs designed to carry certain loads.

A few movements of the disk of the dial and the figures can be read from the face of the calculator, a little work is done with the pencil and the facts are known.

To Protect Eye-Glasses

AS the train started with a jerk the man was thrown violently against the side of the car. While making his apologies he hurriedly pulled an eye-glass case from his vest pocket, and one glance told him that his reading glasses were broken.

The man with whom he had collided pulled out his own case. "It wouldn't have happened," he said sympathetically—"the breakage, I mean—if you'd had this," and he displayed a piece of brass wire formed to fit inside the case and having a bump in the middle to keep the cover in place.



Helping the case keep the glasses safe is the job of the bit of brass



Cots are quickly made comfortable in a folding tent for camping or in field hospitals.

Here's a New Folding Tent for Tourists

ALBANY, N. Y. — A new folding tent, designed by the Albany Tent Co., of Albany, N. Y., is being marketed in the United States. It is a new type of folding tent, designed for tourists and campers. It is made of aluminum and is very light and portable. It can be set up in a few minutes and is very comfortable to use.

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The tent is made of aluminum and is very light and portable. It can be set up in a few minutes and is very comfortable to use. It is designed for tourists and campers and is very popular.

It is so simple in construction that any man can easily handle it and erect it.

A Tip from the Circus

AS the lady in spangled tights seemingly defies laws of gravitation in the flying trapeze, she and the other acrobats are saved from the possibility of one thousand feet by the life-net stretched below. The decks of a submarine offer scarcely greater security than a trapeze, so taking a life-net is a very important part of work on the submarine. A life-net was used at Boston to save a man who fell from a net around her when they had the job of fitting up a deck gun during stormy weather last winter. When a workman slipped and slid down the slippery sides of the hull, he landed lightly and safely in the life-net.

Of course a life-net is not a substitute for a life-line, but it is a very important part of the life-line. It is a very important part of the life-line. It is a very important part of the life-line. It is a very important part of the life-line.



Glass Houses for Marine Searchlights

ALBANY, N. Y. — A new glass house for marine searchlights, designed by the Albany Glass House Co., of Albany, N. Y., is being marketed in the United States. It is a new type of glass house, designed for marine searchlights. It is made of glass and is very light and portable. It can be set up in a few minutes and is very comfortable to use.



Falling overboard from a submarine in drydock would be bone breaking business were it not for the life-net.



A new type of glass house for marine searchlights, designed by the Albany Glass House Co., of Albany, N. Y., is being marketed in the United States.



A tongue- and groove locking device protects this box against the pilferage who make use of famous labels.

A Self-Destroying Box

THE principal reason for non-refundable boxes is that they are not destroyed. But, unless the box is destroyed, it is a waste of money. The new self-destructing box has a unique feature. The one illustrated in the picture is the one of Paul Richard, of Lebanon, N. H., who has a way by which the box is destroyed in opening as to be useless for relocking, but not so broken as to spoil the contents. He relies on a tongue and groove locking device.

In the box cover at the right of the illustration can be seen one of the tongue and groove locking devices which, when the box is opened, the tongue slips into the slot visible in the box at the left of the illustration. It holds the cover locked to the box so that to remove the cover the locking tongue must be torn out; thus insuring against the duplicity of man which sometimes leads him to put inferior goods in boxes with famous labels. Manufacturers who have given years to making their labels familiar to the public, and establishing their guarantee of "good goods," have given these labels a distinct value. Before the advent of the self-destructing box there was no way of circumventing the man who appropriated them.



Transferring caterpillars from one plant to another on a butterfly farm to give them fresh food

Raising Butterflies for the Market

ANYONE who wishes to try farming where small capital is needed might well turn his attention to butterfly culture. At least one man, Mr. Newman, of Kent, England, has found it profitable. He supplies schools and private collectors with specimens and sometimes receives as much as \$60 for a single butterfly. He has customers in all parts of the world.

All that is necessary is a small garden in which many varieties of plants will grow, with some knowledge of the habits of the insects. You find the female butterfly feeding on its favorite plant, enclose her in a small gauze bag tied over the food plant as a safeguard against enemies that would destroy eggs or the young caterpillars, and then watch while eggs change to caterpillars. These spin round themselves silk shrouds, or change by degrees into strange-looking mummy cases. Within two or three weeks a moth or a butterfly will emerge from the shroud. On the Kent butterfly farm over 70,000 caterpillars are maturing at one time producing an average of 500 butterflies a day.



© Photo by William Thompson

Did our Alaskan Indians come from China? Their craftsmanship suggests the possibility. Examples of their art are curiously like that of ancient Mongolia.



Folding a crate to be returned to the shipper to use again

The caterpillars are held together on a plant by the gauze bags tied over them

Return Empty Crates for Refilling

AN empty crate traveling back to the shipper takes as much space as a filled one and for that reason most crates are in a dead loss after being used once. To avoid this waste Eugene B. Johnston, of Glen Hope, Pa., has devised a folding crate which takes but little space when not filled and can be used many times. It has hinged

end and side walls which fold and hook at the ends that catch into a slotted plate which holds the walls in an erect position when in use. The crate has reinforcing slats to enable it to withstand rough usage. These are so placed that they lie under the end slats when folded.

Cousins of the Chinese?

HUMBOLDT, the great naturalist, suggested long ago that the Alaskan natives came from Mongolian stock. This belief gains strength when we compare the arts and crafts of the Alaskan Indians with those of the Chinese and Japanese. The haired and bearded mask shown in the photograph is the work of Kuskokwim Indians, but it is very like the war masks of the early Mongol warriors. The figure on the left, another of Indian production, represents in form the art of the ancient stone workers, specimens of which are found in the southern Yenai Kurgan region by Marie Antoinette Czaplicka, who headed the Oxford Siberian Arctic Expedition and who is now lecturing in this country.

The baskets shown in the illustration are the work of the Attu Indians of Alaska, a fast disappearing race. The baskets are woven under water from a very fine tough sea-grass which seems also to be disappearing.



Not picking device to help California harvest a fifty million pound crop of walnuts

Trapping Walnuts

PICKING fifty million pounds of walnuts in California's 1930 harvest will be simplified by the nut-trap invented by J. F. Franke, of Santa Ana. The device is an iron funnel attached to a long wooden handle. Wires extend down the sides of the funnel curving upward at the bottom to end in coils hung inside the funnel. The walnut-picker drops the funnel over the nut on the ground, presses it to open springs which close again over the nut, like a trap.

The Vampire

IF you have never seen a real vampire, prepare to see one now; for a picture of one appears below. "But she's not beautiful or even fascinating!" you say. Ah, no! A genuine dyed-in-the-wool vampire is an ugly old bat that steals forth at night and bleeds her victims—usually chickens.

This bat and many like her live in the neighborhood of Kalamoon, British Guiana. There is a Zoological Research Station there and one of the men connected with it says "These vampires draw the blood of our pets and chickens but never molested us though we often heard the swish of their wings and felt the air fanned as they brushed our faces."



The vampire as she really is



A pivoted extension fitted with a saddle provides a freely movable seat for the tired busy barber



Chief Shake now keeps this historic war-canoe in the grounds near his house

Chief Shake's War-Canoe

IN past centuries Mongolian tribes navigated long expanses of the Pacific in their war-canoes and these voyages led to the migration of the peoples of the Far East to the islands of the Pacific.

Between the Maori war-canoe and the Alaskan Indian dog-out there is little, if any, difference in construction. The size of the Maori craft was limited only by the size of the tree from which it was hewn.

The picture represents the most elaborate war-vessel that remains as an example of these staunch and highly artistic craft in which voyages were made for either conquest or discovery.

The one shown is the property of Chief Shake of Wrangel, Alaska, and was used for many years on the Stikine River, plying between Wrangel and Telegraph Creek, a distance of about 180 mi. It now rests near the house of the Chief, a relic of the prowess of a race that soon will be gone.

A Seat for the Barber

INSTEAD of having to stand, while he shaves a patron or cuts his hair the barber can now take a seat, and easily move himself around from one side of his victim to the other.

The long-whiskered man holds no terrors now for the tired barber. Seated upon the saddle of an iron extension fixed to the chair, he can take plenty of time to do a good job, propelling himself around comfortably with his feet on the floor.

Carry a Light About Without Holding It

"YOU'LL have to take another man with you to hold the light," warned the night foreman as Big Jim started in a dark corner of the plant on a trouble-hunting expedition to the power switch-board. But Big Jim only grinned. "See this little jigger?" and he snapped up to an overall suspender-button a battery-lamp so that it hung just below the level of his face and threw its beam this way and that as he moved his body. "This is as good as daylight, and I've got both hands free for the job."

Big Jim's "little jigger" was just a convenient application of the familiar electric battery lamp.



A Glass of Water with a Kick

"WHAT a kick!" exclaims the drinker when he takes a sip of the most modern prohibition drink.

A wire connected with a medical coil, its free end connected with a metal container in which is a glass of water; this is the mechanism. Hold the metal container and place your foot on the side of the kitchen stove, or on any other piece of metal, take a sip of the water, and the "kick" will be very perceptible. It is harmless, however, because the electric current which passes through your body at the time is weak.



"Electrify" your friends with a glass of the latest prohibition drink—the current gives the kick

The Man Higher Up

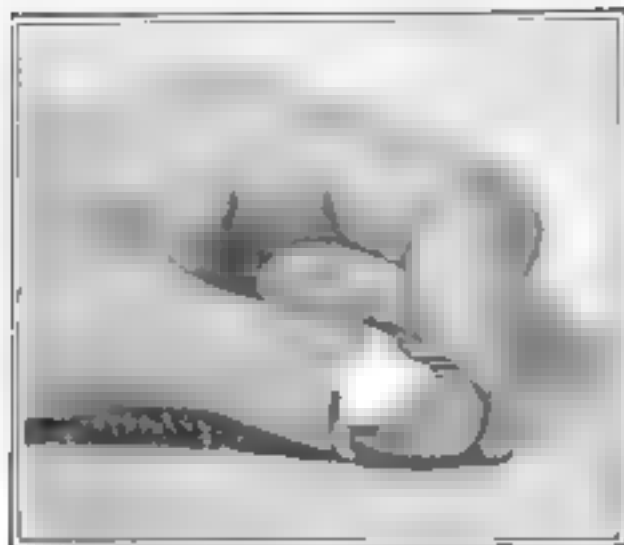
STILPS and their troubles fade into insignificance before the new unicycle shown above. The more we look at it the less we seem able to explain how the owner manages to stay on top and read his morning paper so unconcernedly.

The small wheel is far below him. He sits on a saddle and pedals with his feet, but he has no other viable means of support. His situation suggests that of the impecunious gentleman whose wife supported him on her needle.

How does he start? How does he stop when he gets in heavy traffic? How does he keep his balance between times? And, finally, how does he steer himself around corners?



This electric battery lamp has a device for attaching it to the workman's chest, leaving his hands free



The diamond in this ring is covered with paper through which flaws in the gem show with startling clearness

A Traveling Bar Is a Convenience of the Tropics

ONE needs a steady head to be a barmaid in the Barbados; witness the barmaid in the picture. The photographer who took it says that the liquid coming from the spigot is beer; of course the plan would work as well for lemonade or just plain water.

The liquid in the container is kept cold by being set in chopped ice in what looks like a cheese-box minus a cover. The cheese-box rests on a block cut to fit, and the whole edifice has as a foundation a kind of inverted bench that keeps the cold from penetrating to the head of the barmaid.

We wonder if any of the drops ever defect toward the barmaid's mouth.

She carries an ice box on her head to provide cold drinks for the thirsty



To fill a lantern without spilling the kerosene attach a short rubber hose to the spout of the oil can, like this

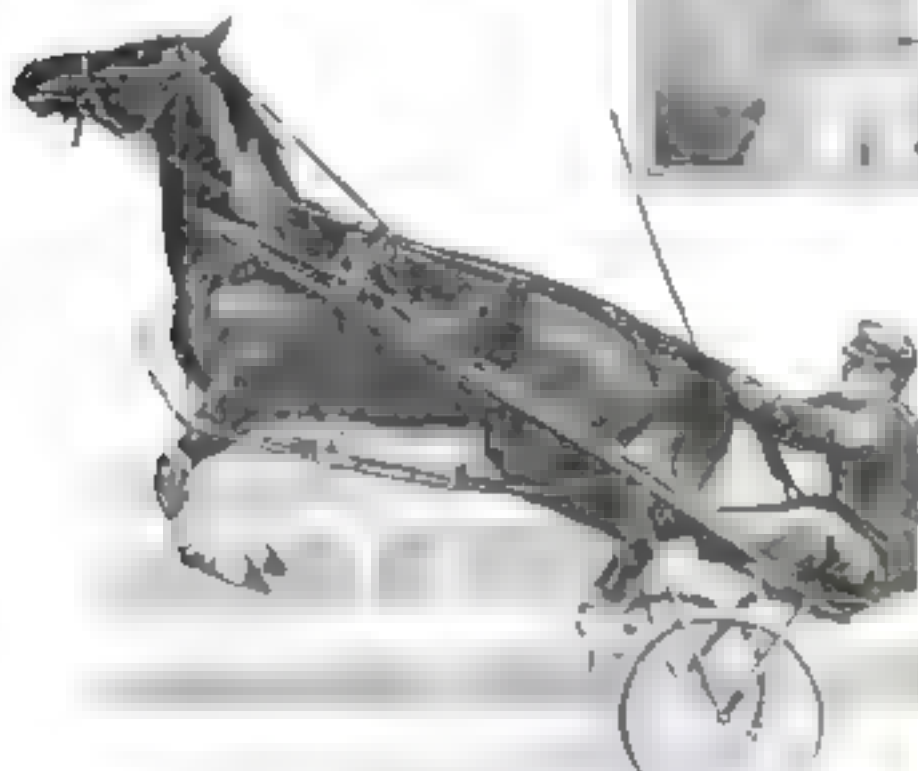
To Detect Flaws in Diamonds

COMMON white cigarette paper will help to show flaws in diamonds. First, to clean your ring thoroughly, roll up a single white paper into a compact cone-shaped roll, smaller in size than a match; insert the pointed end of this between two prongs of the ring, and draw it all the way through. Clean thus between all the prongs. Finish by polishing the surface of the stone with a crumpled-up paper.

Now take a fresh paper and, holding it at right angles to the ring, place the center of it over the stone. Fold each end down, holding between thumb and finger. Touch your tongue to the paper-covered diamond, to moisten it. Any black spots in the stone will now show through in a startling fashion.

All Four Feet Off the Ground

THE eye cannot determine whether or not a horse's four feet are all off the ground at one instant, but the camera has definitely settled the question. The lens winks and catches in one brief look the position which to the eye of man merely blends in with a blurred series of positions.



The camera caught this horse when his four feet were all in the air at once, thus settling a question often discussed

Filling Without Spilling

THERE goes the kerosene, spilling over everything." This is a common expression when one tries to fill the lantern from the ordinary oil-container. The "coal-oil" can has a short spout, and when the can is full it is difficult to make a neat job of filling the lantern. If a short piece of rubber tube is attached to the spout of the can, it enables one to tilt the can at a smaller angle during the filling, thus obviating the necessity of much cleaning-up after the lantern has been filled.

The Mysteries of the Light that Cures

WHITE light, split into its principal divisions and displayed in spectral beauty is as useful as it is ornamental.

The invisible rays beyond the red end of the spectrum, the infra-red, have marvelous powers of penetrating the dense regions of the atmosphere, and photographs of distant objects show more detail when photographed through the red-transmitting filters.

The yellow-green region of the spectrum comprises the rays that enable us to see all the objects around us in their beauty of color. This range of light extends from the visible red to the visible violet. Just beyond the violet is the range of invisible ultra-violet rays.

The light-waves of such extremely short length that they do not affect the retina are possessed of curious chemical powers. They strongly modify the photographic emulsion and cause chemical changes in animal and plant life.



An invention of the late Oscar Hammerstein which has recently been perfected by Mrs. Hammerstein, utilizes the rays of violet light to cure rheumatism in the manner pictured above

Housekeeping Made Easy

Little things that help systematize kitchen work



5. To keep the white of the sheet as bright as the white of the sheet. The white of the sheet is kept bright by the use of the white of the sheet.



6. To keep the white of the sheet as bright as the white of the sheet. The white of the sheet is kept bright by the use of the white of the sheet.



7. To keep the white of the sheet as bright as the white of the sheet. The white of the sheet is kept bright by the use of the white of the sheet.



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11. To keep the white of the sheet as bright as the white of the sheet. The white of the sheet is kept bright by the use of the white of the sheet.



12. To keep the white of the sheet as bright as the white of the sheet. The white of the sheet is kept bright by the use of the white of the sheet.



13. To keep the white of the sheet as bright as the white of the sheet. The white of the sheet is kept bright by the use of the white of the sheet.



14. To keep the white of the sheet as bright as the white of the sheet. The white of the sheet is kept bright by the use of the white of the sheet.

Do It With Tools and Machines

Labor-saving devices for the work-shop



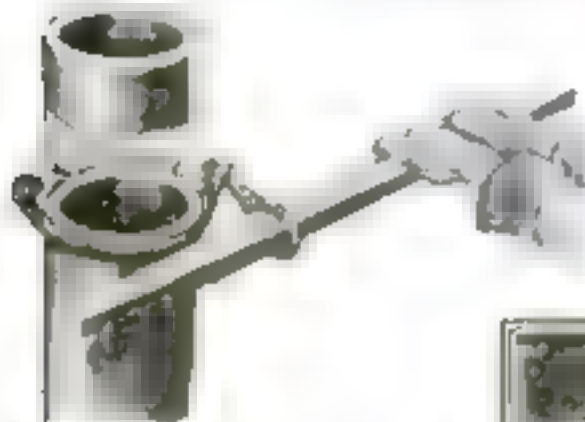
The self-adjusting electric light arm is adaptable to local lighting of any kind. It facilitates placing the light exactly where it is wanted so that it "stays put."



This illuminated tool is intended for use in dark places or where the part to be repaired is enclosed by partitions.



The electric soldering iron, when compared to the type heated in a gas flame or fuel burning muffer, exhibits improvements, both in operation and convenience.



To obtain a grip on a round surface is almost impossible without the proper apparatus. This tool is designed to give an effective grip on a pipe.



Of course you know there is a universal joint on your automobile, but did you ever hear of a wrench having one? With the wrench illustrated you can remove nuts placed at any angle.



A shield renders all working parts of this grinder harmless if the operator makes a mistake. Why not promote a "safety first" campaign in your shop and speed up production?



Weighing only twelve pounds an electrically operated saw can be carried around and used on a job wherever there is the necessary current. Buffer or grinding wheels can be used on the machine in place of the saw, with equal facility.

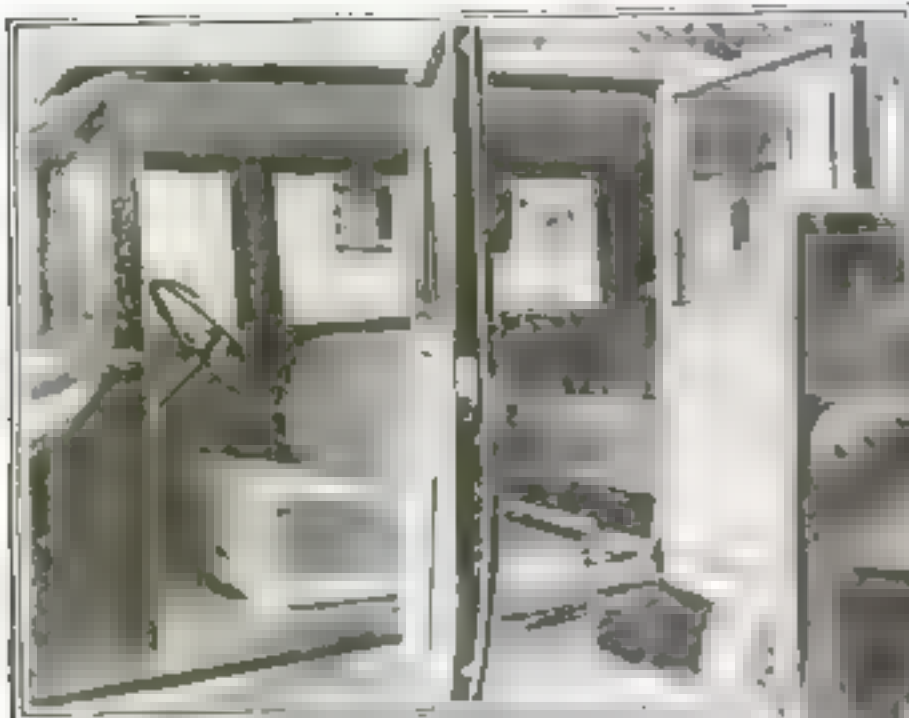


The picture above illustrates a safety lock on the hand-trip of a punch-press which safeguards the operator's fingers without affecting the machine's production.



Most of us have spent valuable minutes trying to adjust a monkey-wrench, the parts of which seemed determined to remain immovable. The jaws of this wrench may be opened quickly by moving the lever outward as shown in the accompanying illustration.

Cranking Up the Automobile Window



The handle is a crank which works closes the window. It has many advantages over the old way of cranking automobiles.

Wheels and pulley that raise the window, operated by a handle on the door.



THE greatly increased demand for enclosed cars such as the sedan and limousine caused by the more common use of automobiles during the winter months, has made it necessary that some new device be worked out for raising and lowering the windows and keeping them at the desired height. The sash-band type of window regulator in which a band of fabric

about four inches wide is employed and fastened to some fixed part of the door by a screw clamp, has not proved entirely satisfactory because the band falls in the way of one's feet when the window is raised. Then again, the clamp sometimes works loose or the band slips out of one's hands, with the

result that the window drops to the bottom of its pocket with a bang. This results in frequent breakage.

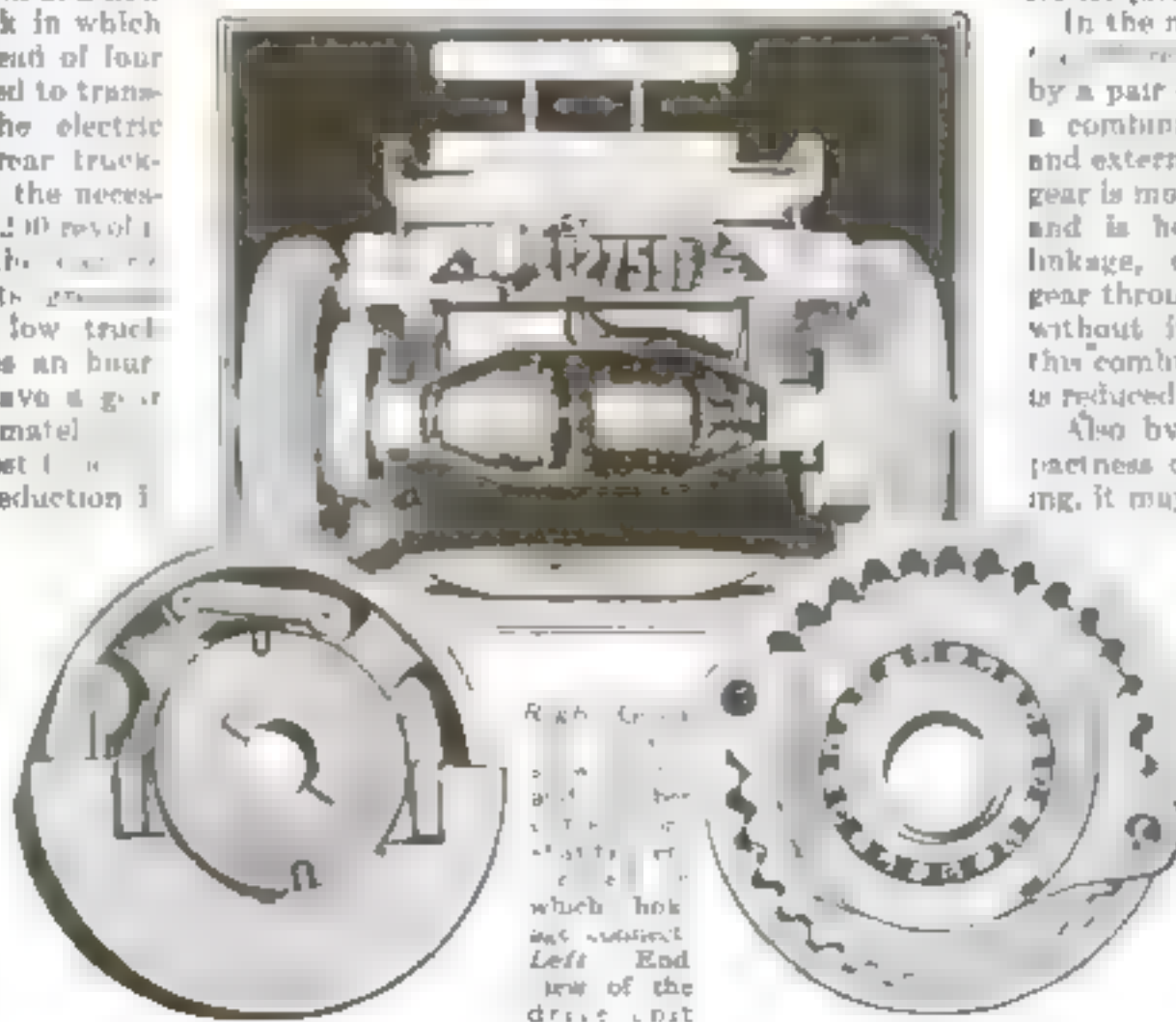
These failings of the old style regulator have resulted in the designing of a new apparatus which overcomes the faults. It is simple and inexpensive to manufacture and is adaptable to either the quantity-production car or the one with a custom-made body. The mechanism is shown in the illustrations.

The picture of the sedan with two doors open shows the neat appearance of the finished window, with but a small handle showing. The broken-away illustration shows how the apparatus is made and how it works. It consists of two gear-like pulleys over which runs a chain turned by a gear mounted on the same shaft as the turning handle inside the car. The base of the glass is attached at one point to the chain, so that a movement of the handle causes the glass to move up or down. Both pulleys are provided with sharp spear-like projections around the edge or circumference. These fit into holes in each chain link as it passes over the pulley and thus make it impossible for the window to slide downward when the car jolts or because of any unusual vibration.

Only Two Gears in This Electric Truck Drive

SIMPLICITY and small frictional loss of power feature the driving mechanism of a new type of electric truck in which only two gears, instead of four or eight, are employed to transmit power from the electric motor to the two rear truck-wheels. Because of the necessary high speed of 2,500 revolutions a minute of the electric motor to give it its greatest efficiency, and the low truck speed of fifteen miles an hour it is necessary to have a gear reduction of approximately sixteen to one. In most electric trucks this reduction is secured through a worm gearing, or a train of spur gearing in which from four to eight gears must be employed. The more trains of gears, the greater the frictional loss of power. Also, on account of the large gear reduction, one of the gears must be made

Mechanism of the unit-drive electric truck is encased in the rear axle housing.



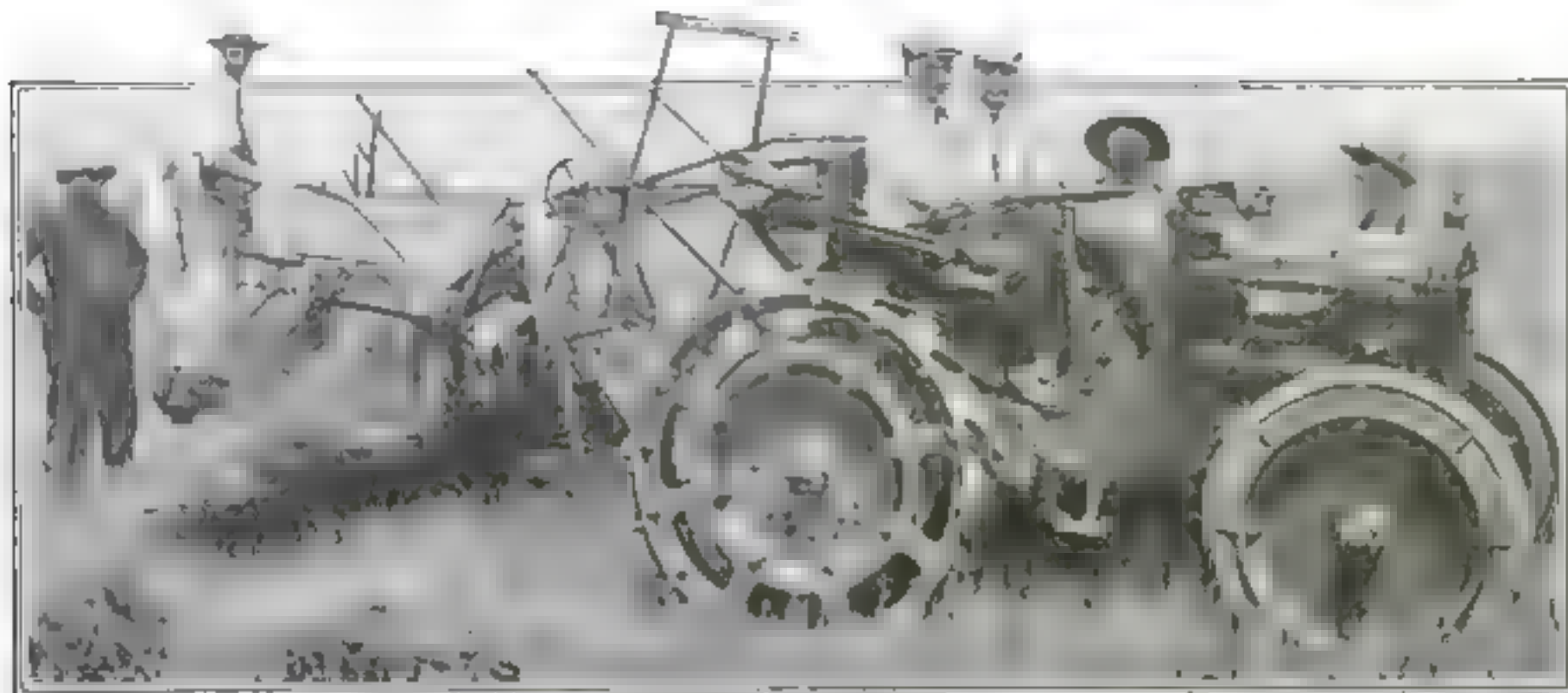
small which results in high speed with consequent wear and need for frequent replacement.

In the new form of reduction the increase in speed is secured by a pair of spur gears forming a combination of an internal and external gear. The external gear is mounted on an eccentric and is held by a system of linkage, driving the internal gear through a gyrating motion without itself revolving. By this combination, frictional loss is reduced to a minimum.

Also by reason of the compactness of this form of gearing, it may be grouped with the electric motor inside of the rear axle-housing, where it is protected from mud and dirt.

The broken-away pictures show how the mechanism of the unit-drive electric truck is encased in the rear axle-housing and how the gears mesh.

It's a Farm Tractor and Motor Truck Too



In the illustration is shown the heavy tractor wheel slipped in place over the rubber tired wheel. By the simple operation of removing it the tractor may be used for hauling on public highways without injuring the road bed. In the picture the tractor is attached to a blade.

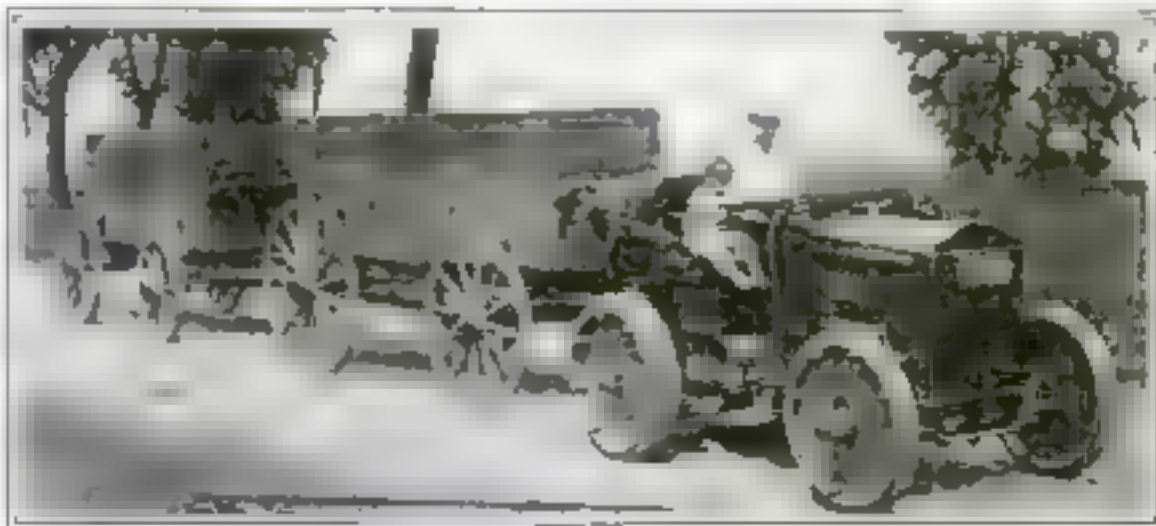
THE great and simultaneous development of the farm tractor and the motor truck as a result of the more efficient farm production and better highway transportation demanded during the war, makes it logical to suppose that future development will lead to some form of vehicle which may perform both the cultivating work and road haulage of the average American farm. Due to the very great difference in the character and speed of the work to be performed, the solution of this problem has not been an easy one. The farm tractor needs great pulling power at comparatively slow speeds but for long periods, while the motor truck, because it operates over roads, requires less pulling power but more speed. Added to these two problems has been the one of quick, simple and inexpensive conversion from one type of vehicle to the other. Then, too, the tractor must be able to furnish the power for all forms of belt work and to do this without interfering with the vehicle as a road transport unit. In other words, the successful motor vehicle for the average farmer must be capable of doing all the farm work that was previously done by horses, and more.

It has been the inability of both the ordinary farm tractor and the ordinary motor truck to successfully perform all the farm work previously

done by horses that has presented the main obstacle to the more rapid motorization of the farm. While the farm tractor has been able to do most of the purely agricultural work on the farm such as plowing, disking, harrowing, cultivating, binding, etc., and also belt work, it has not been able to complete the farm operation of hauling the crops to market. This has necessitated the retaining of some horses on the farm or the purchase of a motor truck which is used only a small portion of the year. On a large farm, the maintenance of a truck which is used for only a small proportion of the year, does not result in a serious overhead expense. However it becomes almost prohibitive on a small farm where the income from crops is not sufficiently large to carry a non-paying investment. It has been the aim of many truck and tractor manufacturers to overcome this difficulty on a small farm by devising a vehicle for both farming and road haulage work.

To John K. Gumper, of Decatur, Illinois, has fallen the distinction of designing and producing one of the first of these new all-purpose farm vehicles of the future. The apparatus is shown in the accompanying illustrations. It follows automotive practice in its design and is a four-wheeled, short wheelbase vehicle with a truck type engine, clutch, gearbox and enclosed and dustproof type of final drive to the rear wheels. All four wheels are permanently equipped with rubber tires to prevent damage to roads when it is used as a highway vehicle. When thus employed, the load it moves is carried in one or more four-wheeled trailers at a fair rate of speed.

The conversion from a road vehicle to a farm tractor is made quickly and inexpensively by slipping larger metal-tired wheels directly over the rubber tires, the tires remaining permanently in place. Both front and rear tractor wheels are held to the steel disk truck wheels by bolts through special lugs cast just inside the peripheries of the disks. By a wide range in the gear set ratios, appropriate tractor and truck speeds may be gained at will by moving the gear-shift lever which is located in the cab, as is done on automobiles and trucks. The rear axle is provided with a power take-off and pulley shaft for all forms of farm work.

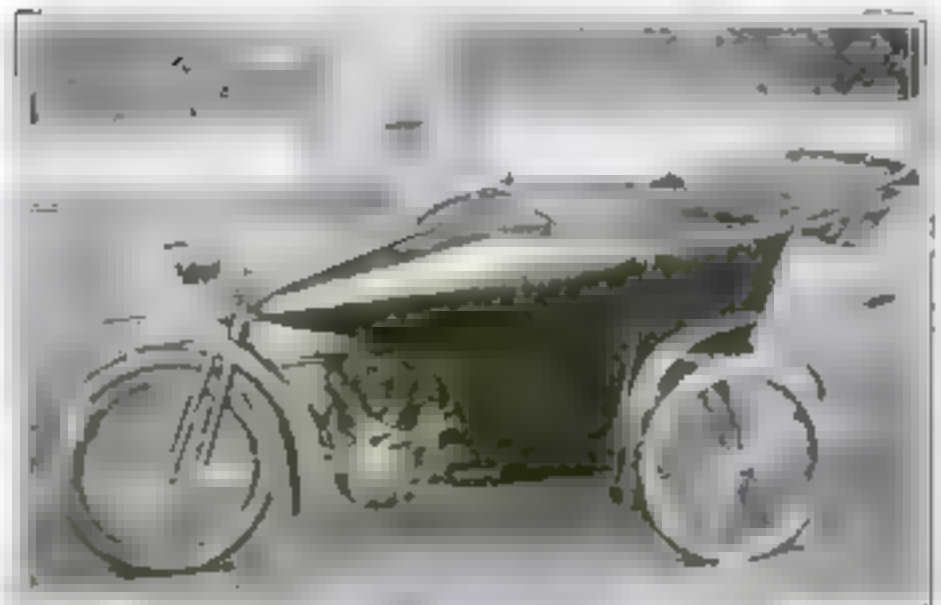


When employed as a truck the farm tractor hauls one or more four-wheeled trailers at a fair rate of speed.

Giving the Automobilist a Novelties that are interesting



A large plate holder will be a benefit to the automobilist who is interested in the latest in automobile accessories.



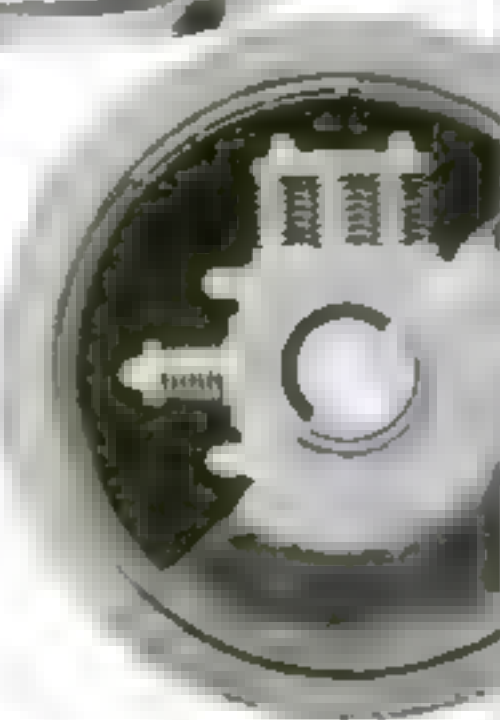
A modern automobile for the automobilist who is interested in the latest in automobile accessories.



Colloidal gas engine is the latest way can be found in the latest in automobile accessories.



This large pump is a benefit to the automobilist who is interested in the latest in automobile accessories.



A motor truck wheel to make travel on the road more comfortable and easier. The stationary springs are a benefit.



Three lawn mowers can be attached to your tractor to cut a wide swath of grass.



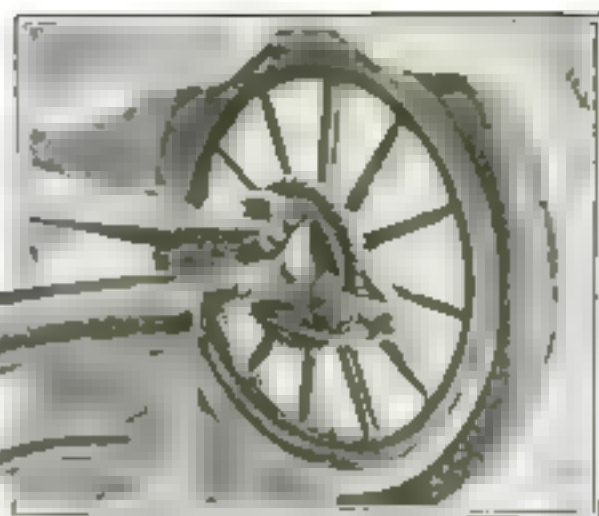
This tractor is pulling down with a steel cable the walls of a burned-out three-story building.

Helping Hand with His Accessories because they are new and attractive



Some boys who wanted to save garden labor saw a motorcycle wreck, obtained the crushed machine and made a tractor from it

HORN PUSH-BUTTON ATTACHED TO THROTTLE LEVER

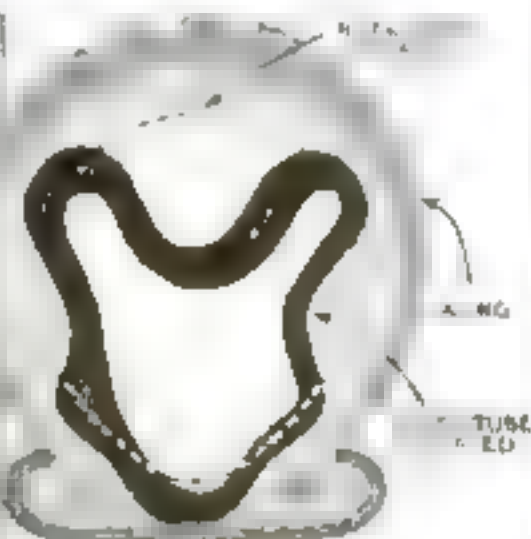


When a car is left on a hill it cannot be started downhill if it is fitted with the ratchet attachment that is shown above

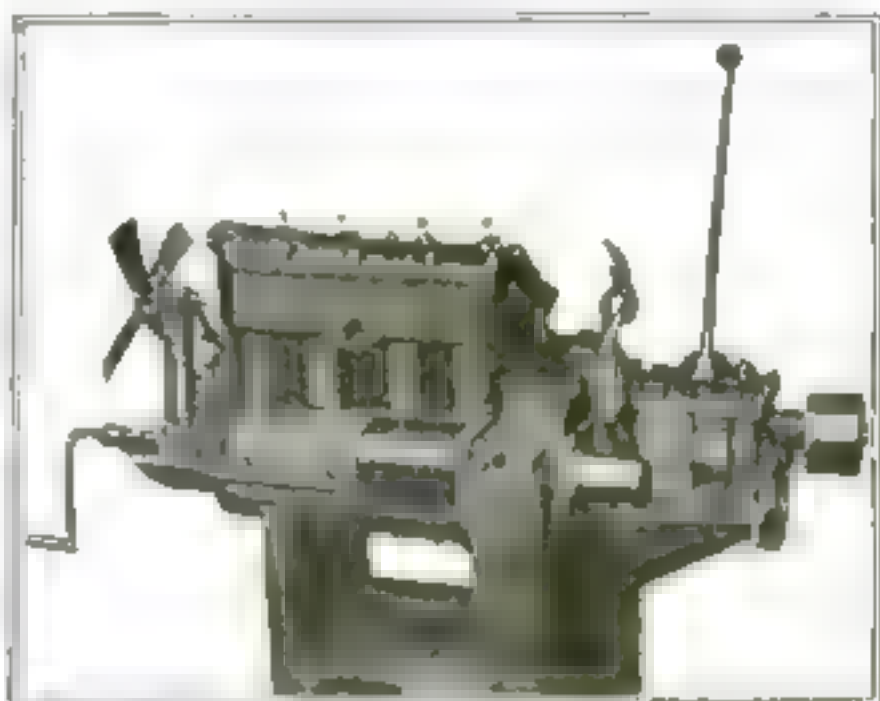
With the push button shown at the left the horn may be blown without removing either hand from the wheel



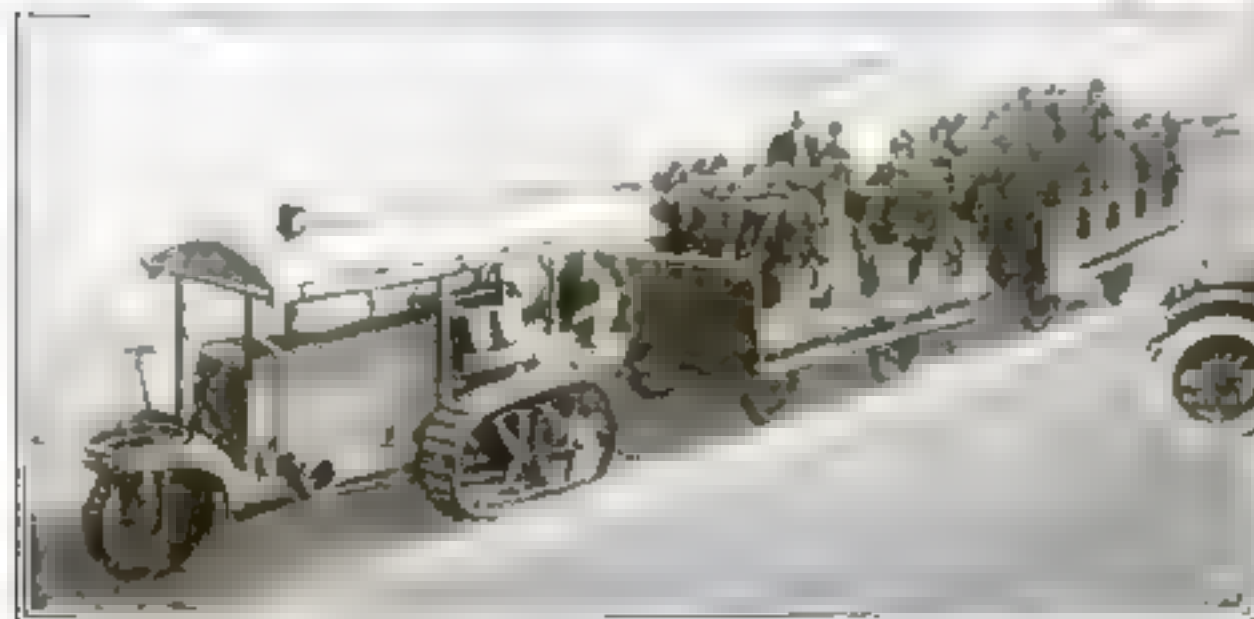
These grease cups have a screw cover that keeps out dirt. They are used on all the moving parts of the engine



This is a compressed rubber tread in an added cushion between the tire and the wheel



The very latest in attachments for Fords is a three-speed sliding transmission such as those used on the big cars. The new unit is mounted on the engine, eliminating trouble with the bands of the planetary system



Visitors to Catalina Island have to be hauled up and down its steep slopes with a caterpillar tractor which trails two passenger trucks



This truck disseminates good-health propaganda. The roof is used as an open air picture theater and the screen is transparent so that the audience can view pictures from both rear and front



The water is robbed of its free oxygen by perforated iron plates in the deoxidizing tank. The rust is filtered out before the water is piped to the tenants.

Why Does Iron Rust?

The answer will solve a question of importance to the house-owner who may easily eliminate the rusty pipe

By Ernest Welleck

IRON is the metal most important to man because it is the most useful to him. Without it our modern civilization would have been impossible. Its strength and durability are proverbial. Yet, it is not an ideal utilitarian material. It deteriorates rapidly by rusting unless well protected.

Protected? Against what? Against influences which cause the iron to corrode. If we wish to protect the iron we must first ascertain the identity of these influences which constitute its enemy, and become acquainted with their methods of attack.

Experience has taught that the rusting of iron is caused by the joint action of two chemical agents, air and water. Iron will not rust in air free from moisture, or in water free from air like pure distilled water.

Distilled Water Solves Problem

If a piece of iron or steel with a clean, bright surface, is placed in spring or well-water, or in water drawn from the faucet of a hydrant, it will soon turn black and dull. If it is left longer in the water, the iron will gradually change its color. Its surface will turn from black to brown and finally to a yellowish red. The change will be greatly accelerated if we take the iron

out of the water and expose the wet metal to the air. In a short time it will be coated with a reddish-yellow covering of rust which will continue to extend deeper into the metal until the iron is changed to a crumbly mass of rust.

Why does spring or well water cause iron to rust, while distilled water does not? The water in springs, wells, rivers, and lakes always contains oxygen in solution, usually in the form of carbonic acid. But if such water is thoroughly boiled or distilled, the oxygen is expelled by the heat and the water thereby loses its power to corrode iron.

Not a Stable Compound

Rust, chemically speaking, is not a stable and uniform compound the composition of which can always be expressed by the same chemical formula. In its first stages it contains but little oxygen. Gradually it draws more oxygen and also some hydrogen from the water or from the atmosphere, forming what the chemists call a hydroxide of iron. Chemists give a highly interesting and complicated explanation of the intricate electrochemical processes involved in the formation of rust. They speak of "dissociation," "ionization," and

"electrolysis," but these terms have no meaning to the average person who is more interested in the problem of preventing rust than in scientific theories concerning causes and reasons of the corrosion of iron.

The rust, which clogs and gradually destroys iron water-pipes in our houses and factories, which eats holes in our kitchen utensils, corrodes our boilers and machinery, and the iron and steel work of our bridges and viaducts, is seldom homogeneous in composition. It is nearly always a mixture of oxides of iron containing variable proportions of oxygen, hydroxide of iron and carbonate of iron, which is formed by the combination of the metal with oxygen and carbon, taken from the carbonic acid dissolved in the water.

Prevents Corrosion

Modern engineering has devised a simple method of preventing the corrosion of hot-water pipes in dwellings and factories. It is based upon the clearly established fact that iron will not rust in water which does not contain dissolved oxygen. The method is illustrated by the

accompanying drawing. The water, derived from the supply system of the city or village, is conducted to a large metal tank, placed horizontally and containing a large number of thin, perforated sheets of a cheap grade of iron. From the lower part of the tank the water passes through the coils of a heater and back to the tank. While the hot water is circulating through the perforations of the iron plates it gives up the oxygen which it contains in solution. Most of the rust formed on the plates adheres to them, the rest is carried by the hot water to a smaller, vertical tank containing a sand filter and is deposited on the filter. The water, free from dissolved oxygen, and therefore no longer able to cause the formation of rust, is distributed to the consumers by a system of service pipes.

The operation and maintenance of the plant require little attention; it is practically automatic in its action. The deoxidizing tank must be opened from time to time and new perforated iron plates must be substituted for those that have corroded.

It is advisable to clean the filter occasionally by reversing the flow of water through the sand, or by removing the rust-stained layers of the filter and adding fresh, clean sand of the same fineness to take their place.

Carrying the Gospel by Motor



The modern preacher doesn't wait for his flock to come to him. He seeks it in the gospel wagon which is his home as well.



MOST preachers move from one place to another frequently, but the pulpits and churches they formerly occupied remain stationary. Not so with the Rev. William Arthur Downer, of Glassboro, N. J., traveling evangelist, who is on a coast-to-coast journey in a specially designed vehicle which includes features of a home and house of worship.

Equipped with conveniences for cooking, sleeping and eating, as well as a piano and Biblical literature, this automobile truck may be described as a "house-on-wheels," or a gospel wagon. The unordained minister and

family of two, together with a traveling companion, enjoy all the comforts of a home, with the exception of a bath tub. Running water is afforded by a 25-gallon tank. A bed installed at one end of the car is for the preacher and his wife, while a folding cot offers facility for restful sleep for the two daughters.

While working as an automobile mechanic, the parson conceived the plan of building a home on an automobile truck chassis. The body of the car, 7 feet 10 inches wide by 22 feet long, is constructed of oak. The

interior of the home of this itinerant preacher is adorned with printed Bible texts. Conspicuous on the exterior is this inscription, "Visitors always welcome." To carry the gospel to the wayward and to the "down-and-out" fraternity is the twofold object of this tour.

If You Could Look Inside a Tractor

IF you could cut a modern farm tractor down the center with a huge knife, as the housewife halves a grapefruit for breakfast, just what would be revealed is shown in the accompanying illustration. More than anything else, this view shows the influence that the automobile has had on the development of the modern farm tractor. Beginning at the right, you discover first, an automobile or motor truck type of gasoline engine, with its speed regulated to a set number of revolutions by means of an automatic sealed governor, such as is employed on motor trucks. If you look closely, you will see that the engine is of the valve-in-the-head type and all enclosed.

Then again, in the pipe between the top tank of the radiator and the top of the engine cylinder block, there is a small nest of copper disks which expand and contract to shut off the circulation of the cooling water through the radiator, so that the engine temperature is always kept at that point at which the low grades of present-day gasoline burn with greatest efficiency. Then the cylinder head is removable, so that the interior of the cylinders and the pistons may be examined without tearing the whole engine apart.

Following the engine crankshaft farther to the left, you see an automobile type of clutch and the driving gears to the rear wheels, all the power-transmitting parts being completely enclosed in an oil bath. This makes for little power loss through good lubrication, and prevents the dust, always stirred up in plowing work, from getting into any of the finely-machined parts. Dust would have the same effect on the tractor mechanism as in the movement of a watch.



Turning the crank pulls toggle arms of the jack together and raises the car.

A Jointed Jack

FROM far away Cook Islands, within the boundaries of New Zealand, comes the ingenious automobile invention of Henri D. Ray, of Avarura, Island of Rarotunga. It is a jack for elevating the axle of an automobile and consists of a base and head to which toggle-joint arms are pivotally connected. Extending through or between jointed portions of the toggle-joint levers is a screw which terminates in a crank-handle. Stops or collars on the screw make it possible to fasten the jack in any desired position.

The pivotal connection of base and head to the toggle-levers makes the device admirably flexible to adjust to the level of any surface.



A half-slice of a farm tractor reveals the simplicity of its mechanism which is far less complicated than that of an automobile.

A Hydraulic Hoist for the Motor-Truck Body



The hydraulic hoist is fast coming into prominence in the automotive field. This one operates with power from the propeller shaft.

shackle. It consists of a vertical cylinder or cylinders, depending on the make of the truck, containing pistons driven by a gear pump. The power to drive the pump is taken from the front propeller shaft or from the amidship transmission and is applied by operating a lever in the driver's seat. The hoist is swung from saddles so that it can give a direct lift on the body at all times. The oil is

stroke. To lower the hoist a valve operated from the driver's seat is opened, which allows the oil to by-pass back into the head of the cylinder. As the piston stands on a solid head of oil, which oil must be displaced by passing through this valve, the body can come down at only one rate of speed. This is an important safety feature in hydraulic automatic hoists. Thus, it is possible for one to work around or under the body of a truck equipped with a hoist and be perfectly safe.

When the wheels of a truck are not turning it is not making or saving money for its owner. It is not so much the truck as its method of operation upon which the success of any kind of truck transportation depends.

A NEW hydraulic motor-truck hoist has recently made its appearance. It is mounted on the chassis frame in front of the rear axle about in line with the front hanger, or rear spring

driven through oil ways to the bottom of the cylinders thus forcing the pistons up. The hoist automatically stops when it reaches its full

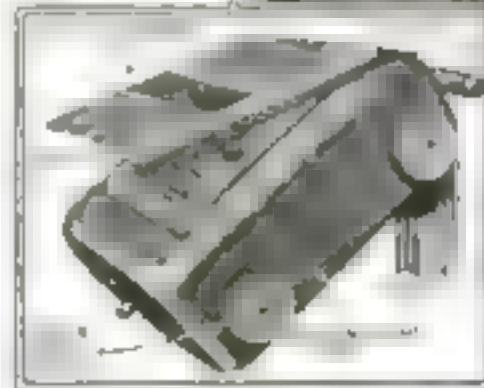
Jot It Down on the Pad

ONE of the latest convenience-giving accessories for the motor vehicle is a memorandum pad enclosed in a small case which can be attached to the panel instrument board or to the steering column directly beneath the wheel. The device is intended for the motorist who desires to jot down his appointments, gasoline and tire records, touring incidents, and the like and for the truck driver to record names and addresses of deliveries to make, or calls for packages; witnesses to accidents, or other operating items.

The case of the instrument is made of aluminum and is provided with a watertight cover to prevent water from getting on the paper. A match-scratcher is placed on the outside of the cover as an added convenience. A

clip for a pencil is provided at the top of the case. The paper is wound around two rolls across a writing surface. The winding is done by knurled knobs at one end of each roll.

Jot down things as you think of them, and give the upper knurled knob a turn to roll the paper back and leave a clear sheet. To refer to memoranda, turn the lower knob and unroll your writing.



Why not have a memorandum pad in your car? It's a handy little device for jotting down notes, appointments, and other important information. It's made of aluminum and is waterproof.

Analyzing the Pneumatic Tire

THE scientist in this photograph may ultimately be able to enhance the purchasing power of the dollar when you buy automobile supplies—not by equalizing the law of supply and demand but through a scientific contribution of a method to determine raw materials with physical and chemical properties of most durable qualities for making tires.

The photograph illustrates how the U. S. Bureau of Standards is plugging samples of rubber from various brands of automobile tires for the purpose of analyzing their physical and chemical properties. Specimens taken from the tires are subjected to what is scientific-

ally described as an accelerated aging test. Conditions in this government laboratory aim to duplicate in a brief period—within the course of a week or two—the age of a tire analogous to that of several years on public highways or under normal conditions.

During a year the Rubber Section of the Bureau of Standards analyzed for the War Department more than 500 samples of rubber, representing 250,000 tires, and having a valuation of \$20,000,000. For example, assistance was extended a manufacturer of solid-rubber tires in improving the adhesion between the tread stock and the hard-rubber base. Also the quality of the compounds was enhanced and valuable information was deducted.



The Bureau of Standards plugs samples of rubber from various brands of tires to analyze them and determine their durability.

Making Your Motor Upkeep Less Expensive

You need not be a mechanic to know certain useful facts

By Fred Gilman Jopp



An inner tube as a cushion for the repair creeper makes working under the car less of a strain

WHETHER it pays you to use an automobile or not, depends altogether upon how your car is treated, and the motorist who realizes this fact is the one that gets the best results. After several months' use—a fairly severe test of any piece of mechanism—the average automobile begins to deteriorate fast, unless it has been given the proper attention; and this is the reason why, in many instances, expensive automobiles are discarded after being in service only a comparatively short time.

It is pathetic but true, that for each motorist who really knows his car in its numerous details, there are thousands who are ignorant of everything save the control. Out of the bitterness of his own experience, the writer offers you this advice: Learn to anticipate trouble by careful reasoning and a thorough study of your individual car.

Economize in gasoline and thereby cut the running cost of the entire car. See that the carburetor is properly adjusted. Lubricate all the running parts properly and keep the tires inflated. See that the brakes do not drag and that the wheels and bearings are adjusted neither too tight nor too loose. Be careful how you run the car, don't try to climb hills without shifting to second speed, or even to first, on a very steep hill. It is the little things that make for automobile economy.

A fellow who doesn't know the trick, will take about twice as long to pump up a tire with a hand-pump as will the



Mechanic's tape wound around the lamp rim and given a quick turn removes the stubborn rim

chap who knows how. Short, jerky strokes that bring the pump-plunger only part of the way up the barrel are the kind which quickly tire you and besides, such strokes take much more time to fill the tire with air. Pull the plunger slowly all the way up; then force it down again just as slowly. By so doing you get the benefit of the full volume of air in the pump-cylinder and you eliminate that tired feeling which accompanies the short, jerky stroke.

A well known rubber company attaches to every shipment of brake-lining a card containing some excellent suggestions. These will be useful

to all motorists who desire to keep their cars in good condition

1. Storage battery inspected every two weeks
2. Grease-cups turned up every 1,000 mi
3. Springs oiled every week.
4. Oil and gasoline connections inspected every week
5. Crank-case drained and washed out with kerosene every 500 mi.
6. Universal joints packed with grease every 1,000 mi
7. Differential and transmission packed with grease or oil every 1,000 mi
8. Spark-plugs cleaned every 1,000 mi.
9. Carbon removed from cylinders twice a year.
10. Valves ground every 5,000 mi.
11. New piston-rings every 18 months.
12. Wheels aligned once a month.
13. Water in circulation every time car is started
14. Wheel bearings inspected monthly
15. Carburetor cleaned monthly.
16. Self-starter inspected monthly
17. Steering-wheels and knuckles inspected weekly
18. Brakes tested and equalized monthly

Don't be a "clutch rider"—a fellow who keeps his foot continually on the clutch. On some cars clutch riding



Elusive things, such as bolts and nuts, when they drop into the drip-pan may be found by means of a toy periscope to which is attached a little flashlight

will invariably burn out the thrust-bearing, because of the mechanical construction. The weight of the foot has a tendency to release the spring tension and make the clutch slip. Slipping is a waste of power, and promotes friction which wears away the contact surfaces, at the same time adding to the slipping propensity. Keep your left foot on the floor boards and practise so that you can raise it automatically to the clutch when necessary.

Removing the wheels is usually a hard job, but if you know how, it is as easy to do as anything else about the car. Tie a piece of rope to either side of the wheel, leaving enough room to insert a jack between the rope and the end of the spindle. Place the foot of the jack against the rope, and the head against the end of the axle; then slowly work the jack so that a pulling force is put on the wheel through the rope. This method is one that should be remembered, for it will remove the tightest wheel.

Make sure that the spark-plugs fit tight and that they are provided with good copper asbestos gaskets. If the spark-plug porcelain is cracked, it will allow the compression to escape. Inspect the pet-cocks or priming-cups and see that they are all tight and that they stay closed all the time.

The piston-rings may have turned so that the openings are all in line, or you may be using such a light oil that the engine does not get a tight compression seal. Oil,

when heated, is very thin. In some cases patented piston-rings will help eliminate the leakage, but if the cylinder is worn oval, there is no remedy except that of re-boring it. Kerosene will free the rings of carbon, but it is best to use it only when you are ready to drain off the old crankcase oil.

Special care should be taken with the connections in the lamps and at other points. A short-circuit occurs when two wires of opposite polarity are in metallic contact. Under such conditions the storage battery will be discharging and there will be no lights at the

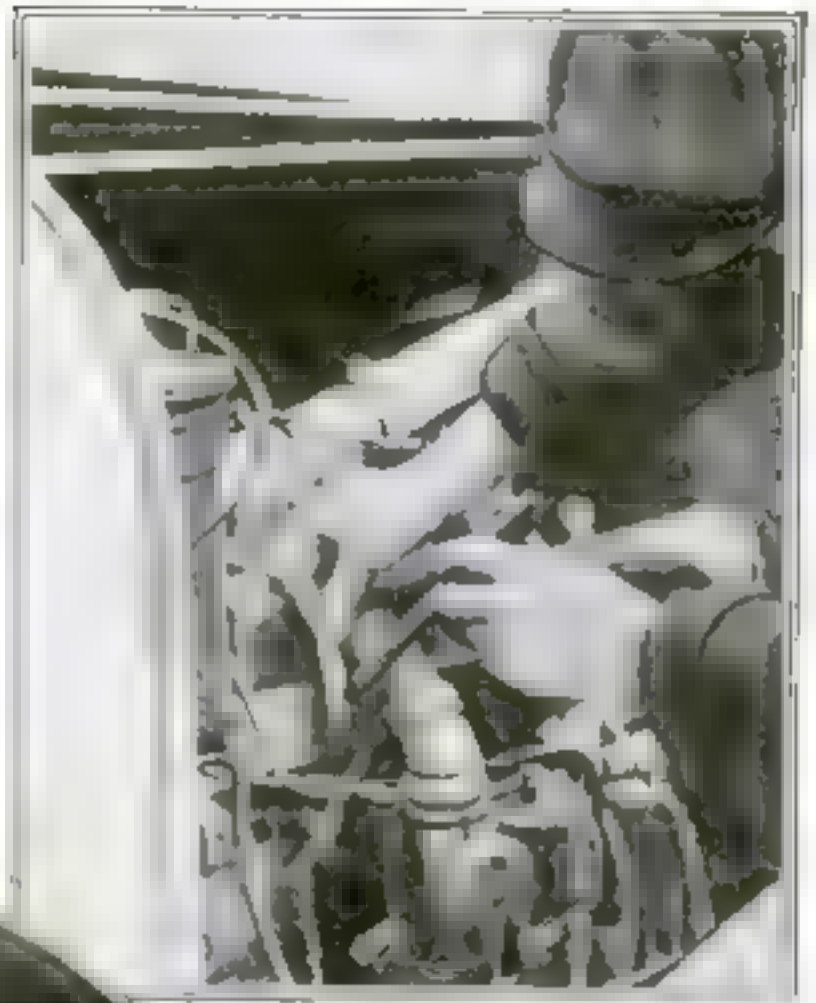


For the dark a flash-light held to your screwdriver by adhesive



If the jack is worked against the hub of the wheel and a rope is tied around it, the stubborn member will soon come off the axle. This idea sometimes will save hours of work.

under the valves will prevent them from seating. The remedy for these difficulties is to keep the engine free



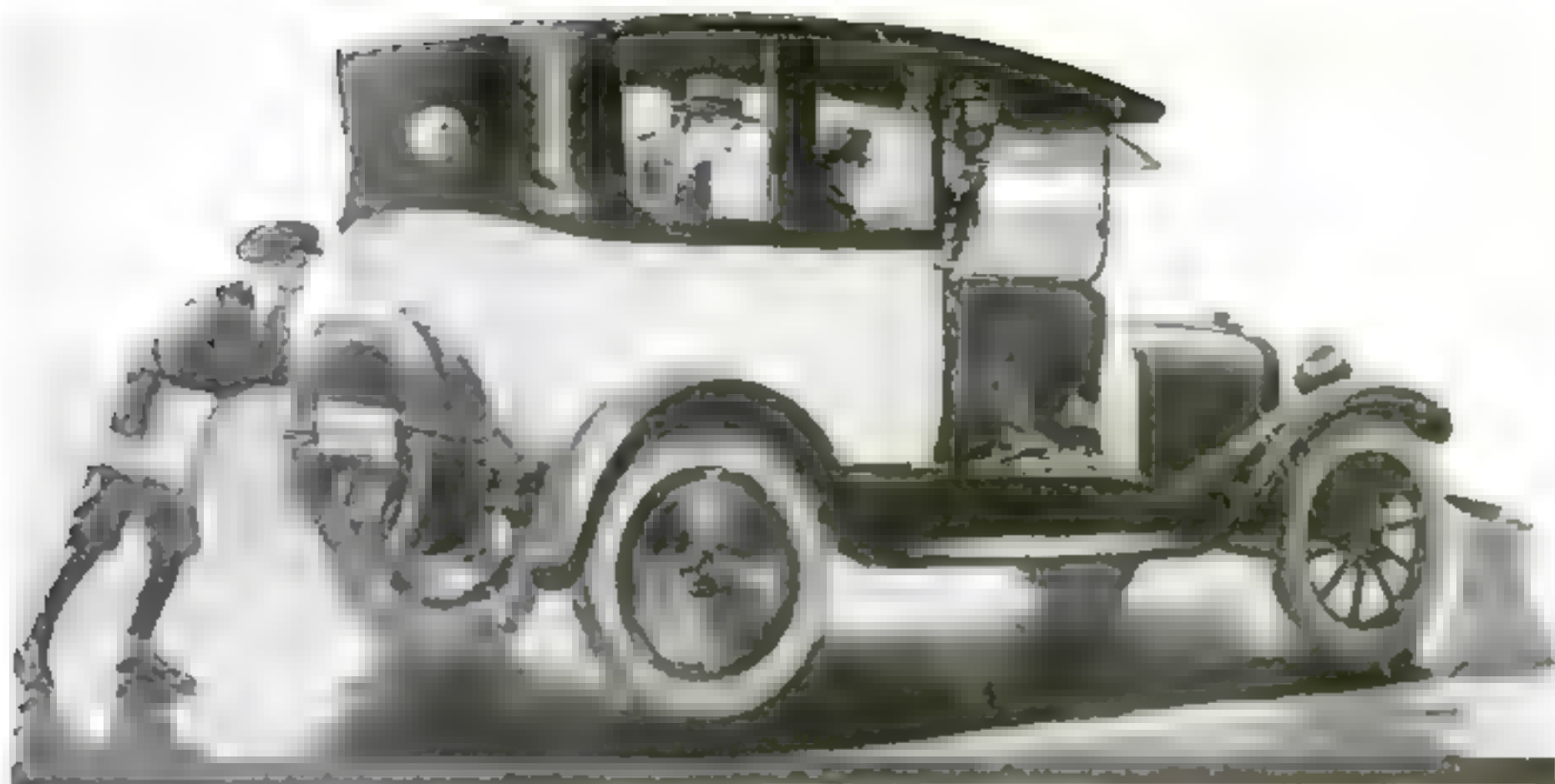
Did some near-mechanic ever monkey with your perfectly adjusted carburetor? Put sealing wax on the adjusting screws

from carbon, and the valves clean, and to be sure that the timing of the valves and tappet adjustment are as set down in the instruction book which accompanies your car.

A graphite preparation in the oil, in suitable proportions, will make a very perceptible improvement in the compression of an automobile engine, and this will be more apparent on an old car. It will also increase the oil economy and keep the engine in better running condition. When an engine, regularly cleaned with kerosene, lubricated as described, and with valves ground regularly, shows a serious loss of power, the lack of compression may be traced to the piston-rings. The cause thus narrows down to plain wear, granted of course that other possible causes, such as wear of the valve stems, push rods, etc., are eliminated.

One reason for loss of compression lies in the use of that boon of the present-day motorist, the self-starter. The man who cranked his engine by hand knew the "feel" of the compression.

Few owners are aware of the value of soap for sealing leaky joints in the gasoline system. Often gasoline oozes out around the filler-cap, especially when the tank is nearly full. The gasoline then spreads over the outside of the tank, collects dust, and impairs the finish. A coating of ordinary soap on the gasket and threads will prevent leakage. When joints develop small leaks, a coating of soap will usually close them.



Plenty of Power but no Traction— spinning wheels that get nowhere

—and the man in the taxi believes he is paying for the futile spinning of the wheels. The meter on his car back home would register them in miles.

He believes the taximeter is registering a charge against him for the useless spinning of the rear wheels and the resulting damage to the tires.

A valuable object lesson, if it makes him think of his own car and how he abuses his own tires when he fails to put on

Weed Tire Chains For Sure and Certain Traction

The taxicab companies protect the Public and themselves from skidding accidents—from excessive costs. Taxicab wheels spin only when drivers disobey the companies' order to "Put on Tire Chains when streets are wet or slippery." And to safeguard their patrons against the drivers' possible negligence, the taximeter is attached to front wheels.

Weed Tire Chains, when used judiciously, lengthen the life of tires. Whether they are used on taxicabs or on pleasure cars, Weed Tire Chains materially reduce operating expenses.

Nothing looks more ridiculous than a spinning tire—nothing more brainlessly extravagant. Put on Weed Tire Chains "at the first drop of rain."



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Defining the Electric Current—Hydraulically Speaking

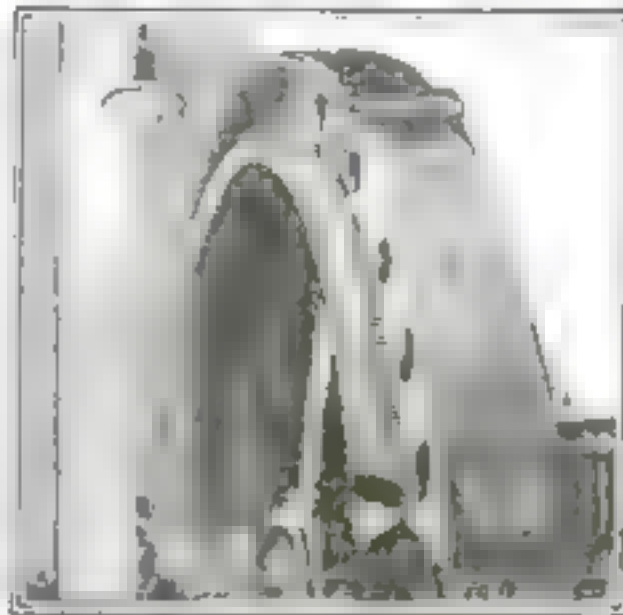
By L. B. Robbins

WHEN you think of volts, think of pounds. When you think of amperes, think of quarts. When you think of ohms, think of the resistance offered to the flow of a liquid by the diameter and length of the iron pipe through which it flows. When you think of watts, think of the power resultant upon the combined efforts of these three.

The electrical terms in every-day use are simple to the electrician, but they invariably try the brain of the layman, so this hydraulic analogy is used, and appears to be the easiest means of initiating one into the world of electrical nomenclature.

Look at Fig. 1. A coffee-can filled with water will create a pressure of about 4 oz. when the water is forced out of a pipe in the bottom. The reason for this is the hydraulic law that water elevated 1 ft. will create a pressure of $\frac{1}{4}$ lb., or 4 oz. Therefore a coffee-can, being 6 in. high, will show half that pressure, or 2 oz. So much for the hydraulic end of the argument.

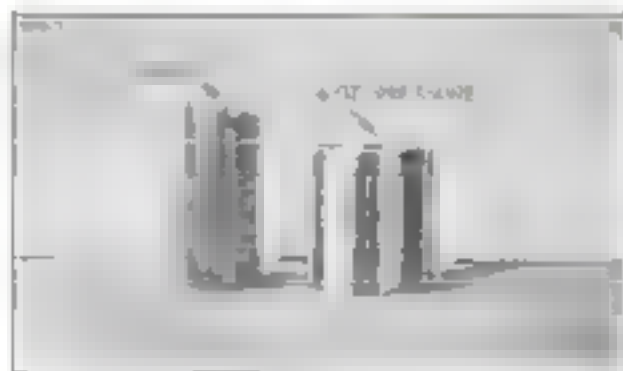
An ordinary dry-cell discharges electricity at about $1\frac{1}{2}$ volts. This word "volt" is an electrical term for pressure, used just as pound is used to designate pressure when speaking of water. So, the electrical current contained in the dry-cell is sent out through the wire at a pressure of $1\frac{1}{2}$ volts just as the water was discharged from the can at 4 oz. pressure. These two units, $1\frac{1}{2}$ volts and 4 oz., will stand as measurements in the illustrations to follow.



Do you know the meaning of electrical terms? No? Then read this article which simplifies them for you

Now, with the volt clear, what is an ampere? Roughly speaking, an ampere represents quantity; that is, the amount of electricity that was discharged at a pressure of $1\frac{1}{2}$ volts.

Reducing this to simplified terms, let us say that the coffee-can held 1 qt. of water. A dry-cell contains about 30 amperes. The former was discharg-



A coffee can filled with water will create a pressure of about 4 oz.

ed at 4-oz. pressure, while the latter was discharged at $1\frac{1}{2}$ volts pressure.

Now, supposing you wish to produce a water-pressure of 12

oz., what shall you do? Just build up a column of water 18 in. high instead of 6 in. high, and you will get 12-oz. pressure instead of 4-oz. To accomplish this result, you must, of course, imagine that the bottoms of the two upper cans have been removed so that the water in the three cans has become one column. This rule holds true with three batteries when connected in "series," as shown in Figs. 2 and 3. By connecting the positive terminal of one cell with the negative terminal of the next, and connecting the remaining opposite terminals together, the electrical pressure is increased to three times what it was before.

But there is another way of connecting batteries that shown in Fig. 4. By this method the pressure is kept to that of a single cell, but the

output, or quantity, is multiplied. This is called parallel connection.

Try to imagine the three cans set along in a row, connected together with pipes, and discharging their contents through a vertical pipe as before. You will readily see that the vertical pressure remains the same as if the contents were discharged from one can, since 6 in. is the maximum height of any one of the cans. But there will be three times as much water discharged from the three as there would be from the one. That is, 3 qts. of water will be discharged at 4-oz. pressure, whereas in the case of one can there was only 1 qt. In the same way, batteries can be connected up to discharge the contents of the combined number of cells at a pressure of only one. This is done by connecting in parallel, or by connecting all of one terminal together, all of the opposite ones together, and then connecting those wires to form the circuit. This is known as parallel connection.

Then again, there are times when a high amperage is desired, together with a high voltage. This is effected by what is known as the "series multiple" connection—Fig. 5. As will be seen two or more cells are connected in series. Then a like number are connected in series and arranged beside the first. After a sufficient number of these sets are arranged they are connected with

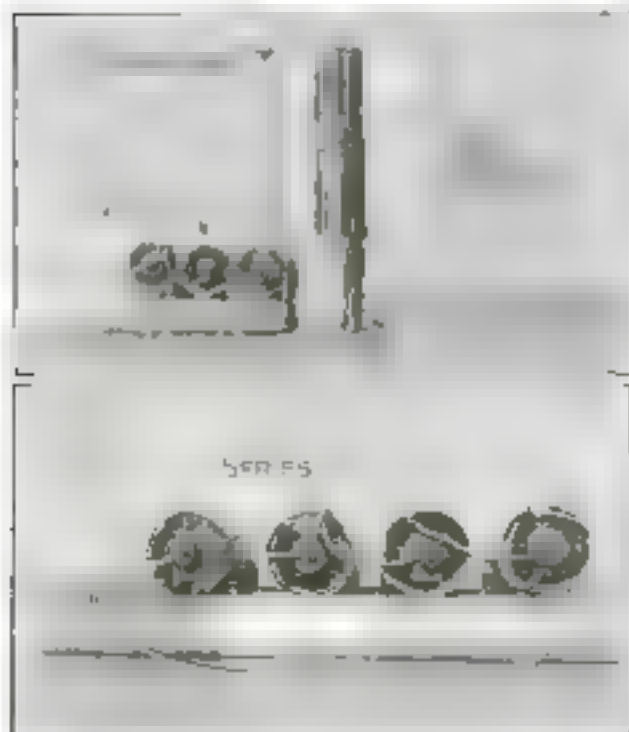
one another in parallel. Then, by connecting those sets in parallel, we get the voltage represented by each set, with the sum of the amperage contained in all the cells, just as was shown in Fig. 4. Instead of trying to im-



This is called parallel connections, which means that output or quantity of current is multiplied

agine this, just imagine that two columns, each containing three cans, were placed side by side and then connected together, discharging through one pipe. Instead of getting only 3 quarts of water, we should then get 6, thus doubling the quantity at 12-ounce pressure.

(Continued on page 94)



Figs. 2 and 3 illustrate how a water column 18 in. high instead of 6 in. will make 12 oz. instead of 4 oz.



When high amperage is desired together with a high voltage, the batteries are connected in multiple series



Equipment used by The Goodyear Tire & Rubber Co.

An Order, Two Plants—and the G.T.M.

The first time the G. T. M.—Goodyear Technical Man—talked with this Company that today has two plants practically standardized on Goodyear Belts he virtually declined an order. He had an opportunity to sell a belt of the same dimensions as the one which had just worn out after a short term of unsatisfactory service. Instead, he demonstrated the value of an expert study of belting quality and working conditions.

The Bimel-Ashcroft Manufacturing Company had been having costly trouble with a 14-inch, 5-ply belt on the main drive in their Morehouse Mo., plant. Time after time they had had to cut it because it stretched. Every cut meant a shut-down of the main drive, involving heavy loss of production. When, finally, the stretch was eliminated, the rawhide lacing began to break, the lacing holes pulled out, and the belt began to open at the plies. So they decided to get a new belt, and told the G. T. M. to send on a 14-inch, 5-ply belt.

"Let me recommend a 14-inch, 7-ply Goodyear Blue Streak," said the G. T. M. "Your drive calls for a stronger belt than you have been using. Among the drive factors affecting the belt is a starting load 50% heavier than the running load." He went on to show how his analysis included every factor of power, pulley dimensions, and general service conditions. His recommendation finally was accepted on the strength of what he showed he had learned about that drive.

The Goodyear Blue Streak's success not only put an end to the main drive troubles but opened the way for analyses of the entire plants of the Bimel-Ashcroft Company at both Morehouse and Poplar Bluff. Today, two and a half years after the G. T. M.'s study of that one drive, 82 of the hundred belts in the Morehouse mill are Goodyear, and so are 50% of those in the plant at Poplar Bluff. As fast as any other kind of belt gives up a job, a Goodyear Belt takes its place.

In the racking service of the high speed saws and lathes, Goodyear Glide Belts serve the tools; on the heavier drives of the bolting saws and the heading saws, Goodyear Blue Streak Belts withstand the severe duty with an in built strength. These belts vary in length and width and plies and type of construction, but they are uniform in the quality that repays their slightly greater first cost with an ultimate operating economy. They deliver full power, hold the pulleys in a friction-surface grip, hold at the plies and wear both evenly and long.

The G. T. M. is at your service. If his recommendations prove valuable to you, our return will be increased, as it has been in this instance, by your satisfaction. For further information about the G. T. M.'s method, and about the belts which Goodyear builds with the care implied in the command, "Protect our good name," write to The Goodyear Tire & Rubber Company, Akron, Ohio.

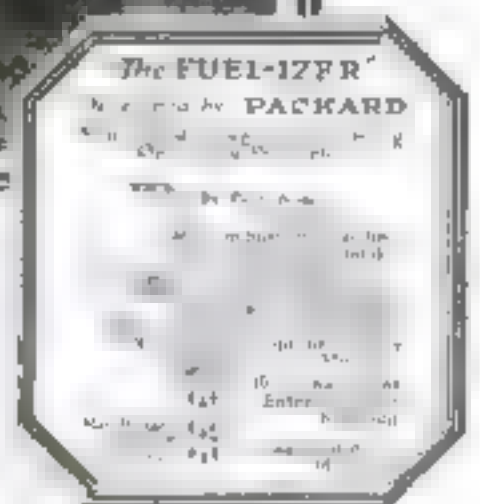
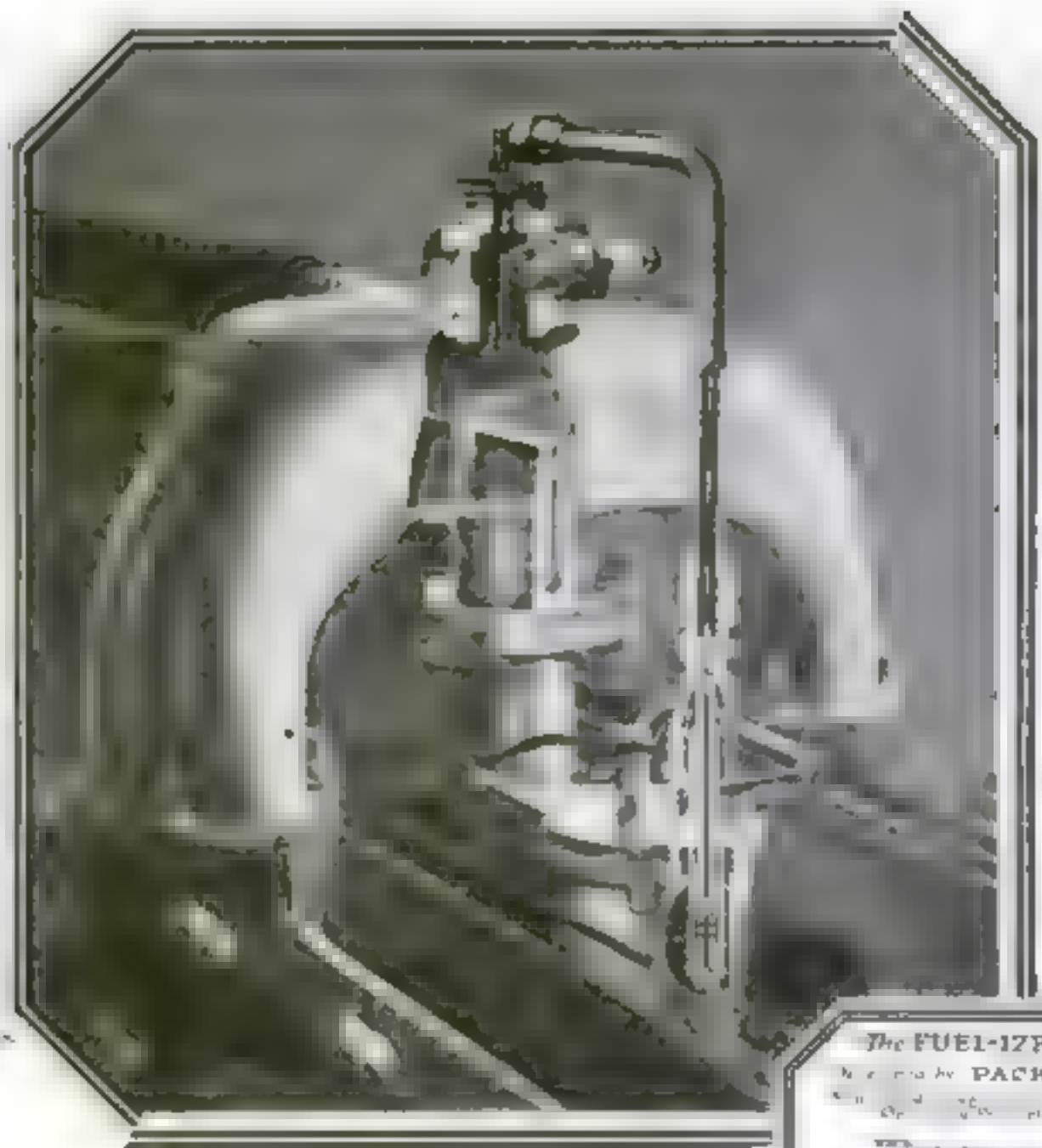
BELTING · PACKING · HOSE · VALVES
GOODYEAR

Packard scores another

The "FUEL-IZER"

Makes Any Gasoline a Perfect Fuel

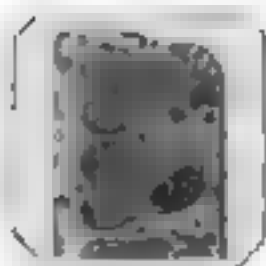
Sectional view of Fuelizer built into the carburetion system, forming a bypass between the float chamber of the carburetor and the manifold. The arrows show its operation. Automatic. Silent. No moving parts. No adjustments.



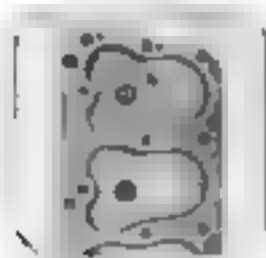
PACKARD MOTOR CAR

Engineering Triumph

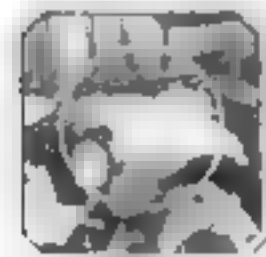
This Marvelous Achievement Standard Equipment on every new Packard Car - Simple, Positive, Automatic - Gives Packard owners Freedom from Carbon troubles, Spark Plug fouling, Cold Weather Starting troubles - and Protects Oil from dangerous dilution



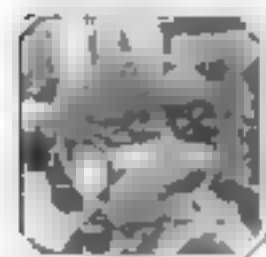
Part of cylinder head - motor without Fuelizer. The best designed motors known show such carbonizing in a few thousand miles.



Part of cylinder head. Motor equipped with Fuelizer. Mirror surface of cylinder head unchanged after 5000 miles.



Motor completely packed with snow. Temperature of air was 11° above zero. Seldom is a motor in actual service so thoroughly chilled.



Motor started instantaneously. The Fuelizer rapidly cleared its way through snow. Perfect response to throttle maintained in 10 seconds.

WITH the development and perfecting of the "Fuelizer"—Packard Engineering again demonstrates its faculty for going to the heart of a problem and getting practical results.

The Fuelizer achieves perfect combustion of all grades of gasoline.

It makes starting as quick and sure in winter as in summer.

It makes available the power in any grade fuel more quickly.

It does away with carbon fouling of combustion chamber, crankcase, valves and spark-plugs.

It does away with the dilution of lubricating oil in the crankcase—removing the main cause of premature wear on engine bearings and scoring of cylinder walls, and preventing sticky valve guides and valve stems.

• • •

Small wonder that the Fuelizer proved the sensation of the recent annual meeting of the Society of Automotive Engineers!

Every motor engineer had known for years that the proper application of heat will break up "wet" mixture.

How to apply the heat has always been the problem—now solved by the Fuelizer.

The Packard Fuelizer not only applies the right degree of heat at the right place—

But the more important still—it applies the heat at the right time—when the engine is cold at starting; and maintains an ideal heat—not overheat—under all running conditions.

• • •

These illustrations tell, better than many words, how the Fuelizer does its wonderful work.

A small part of the mixture is drawn into the Fuelizer and exploded into hot gas by the spark-plug.

This hot gas is drawn down through the Fuelizer heating manifold into the "wet" mixture in the main manifold. It heats up and breaks the "wet" mixture into a dry vapor, which explodes completely in the cylinders.

No time lost in "warming up"!

The Fuelizer has raised the manifold temperature from 33° to an ideal temperature (120° or over) in less than forty-three seconds—2" a second!

Tests made last winter at 5° below zero showed that the engine is able to pull on high gear almost immediately.

During the months of testing after the perfecting of the Fuelizer, not one single case developed of foul spark plug or valve, combustion chamber wall or piston rings. Nor was there any dilution of oil.

Winter or Summer, the Fuelizer revolutionizes motoring—reducing repair bills—lengthening the useful life of a motor.

A Packard achievement, exclusively Packard—now standard equipment with every new Packard Car.

In every way a development worthy of the long-established Packard tradition of practical transportation service to the owner of a Packard Car.



Cylinder without Fuelizer showed lubricating oil diluted with over 7 ounces deposits of carbon in 4 hours of idling. With Fuelizer, no dilution.



Left—Valve from Fuelizer equipped motor after 6000 miles. Right—Typical carbonized valve from motor without Fuelizer. Note burning of metal.



Any Car without Fuelizer, if started after idling, exhausts tons of unburned gasoline and wasted oil.



Packard Car with Fuelizer went instantaneously invisible exhaust after idling or when starting indicated perfect combustion.

"Ask the Man  Who Owns One"

COMPANY, Detroit, Mich., U.S.A.

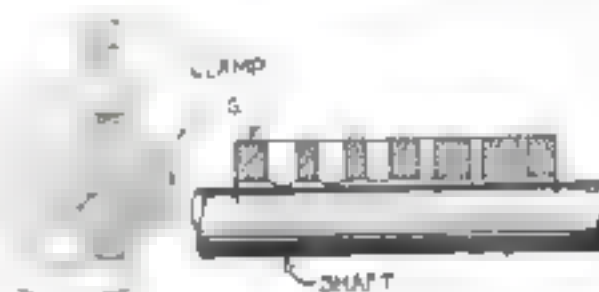
While the foregoing illustrations furnish rough comparisons, it must be remembered that even in the case of water there is always a resistance offered to the water in motion, which would cut down the resulting pressure at the outlet. Elbows, stop-cocks, and internal resistance due to friction, all tend to cut down the theoretical pressure. So, in the case of electricity, the wires and elements through which the current flows tend to lower the pressure or voltage. This resistance can be measured in units called ohms, and is different for every substance through which the current is forced.

Then, just as the working pressure of the water is less at the outlet than at the supply, so the working ability of electricity depends upon the quantity discharged, multiplied by the pressure, with the resistance subtracted. This amount is expressed in watts, the resulting unit of electrical power.

Of course, there are many and varied applications of these electrical terms, due to complicated outside forces; but their analogy to the measurement of hydraulic power is close enough for the instruction of the layman and should make his understanding much easier.

A Jig for Drilling Round Stock Accurately

WHEN drilling the smaller sizes of round tubing and rod, it is a difficult matter to attain a high degree of accuracy, on account of the tendency of the drill to slip a bit to the side when it is being started. This tendency is apparent even when the rod or tubing is held in V-blocks and clamps on the drill-press table, and an accurate and deep center-punch mark has been made. Even then the drill



The way to insure accuracy in drilling round stock is to have the drill in line

will spring slightly and the cutting-lips will work a bit out of line. The slight inaccuracy thus caused will be magnified in proportion to the diameter of the material being drilled, and the drill, when it emerges, will be out of center.

The only way to insure accuracy in starting the drill, is to employ some means of holding it in line until it has a good start. The little jig shown in the illustration will do just this, if it is carefully made. It consists of a rectangular block of steel, with holes carefully drilled along its length by the various sizes of drills that it is to accommodate, the holes being exactly

CHASE

WRITE FOR SAMPLES

L. C. CHASE & CO. BOSTON

Leatherwheels

THE UPHOLSTERY OF QUALITY

MADE BY SANFORD MILLS, SANFORD, MAINE



Champion

Dependable Spark Plugs

Factory Equipment on Ford Cars Since 1911

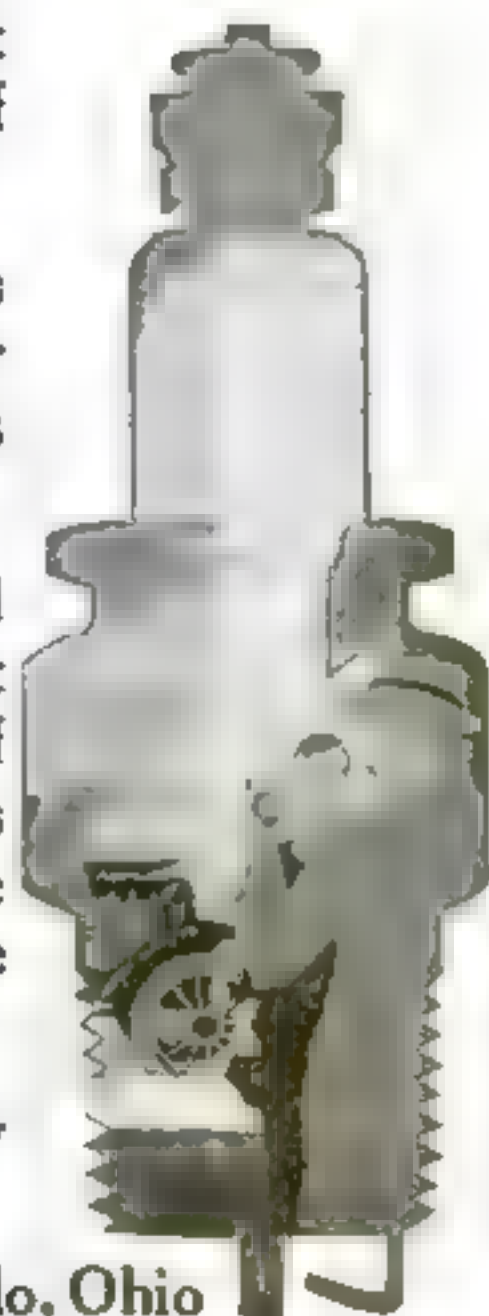
IT is quite unnecessary for Ford owners to risk experimenting with spark plugs.

A long time ago, in 1911, the Ford Motor Company chose Champion Spark Plugs as best adapted to the requirements of the Ford car.

The judgment of Ford engineers is summed up in the Ford Motor Company's instruction book as follows:

"There is nothing to be gained by experimenting with different makes of plugs. The make of plugs with which Ford engines are equipped when they leave the factory are best adapted to the requirements of the motor."

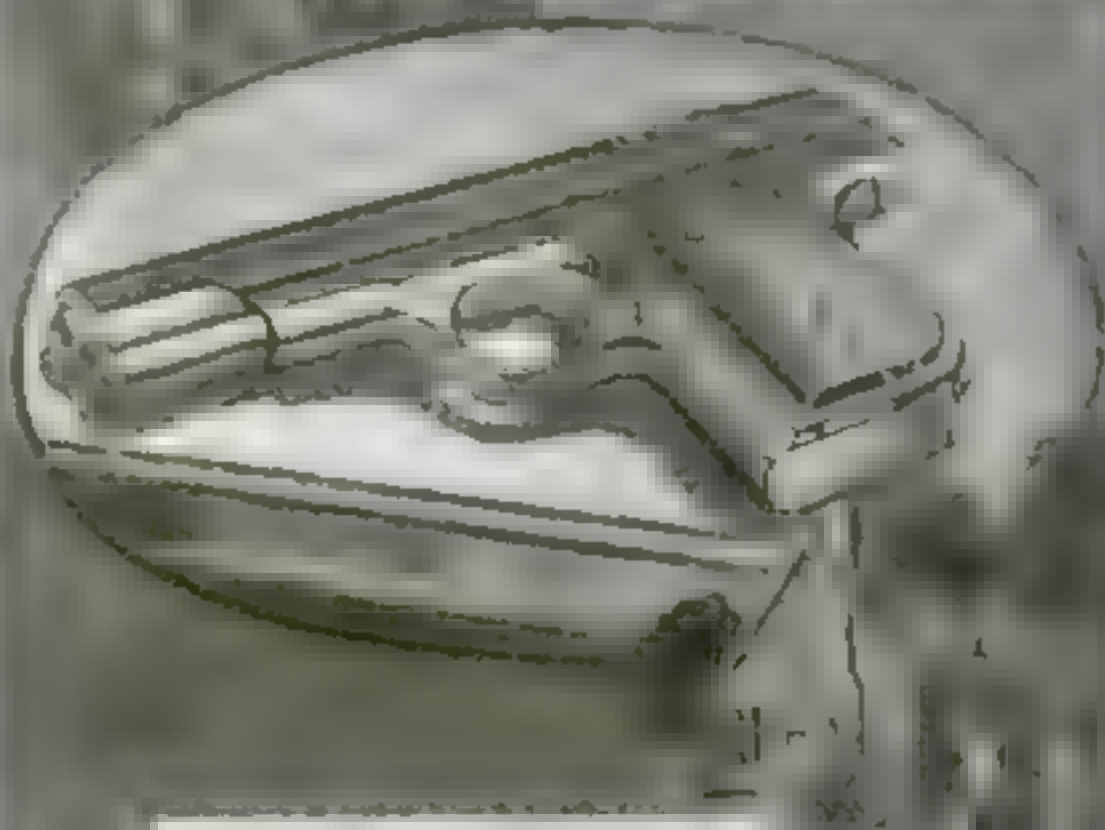
*Be sure the name Champion is on the Insulator
and the World Trade Mark on the Box*



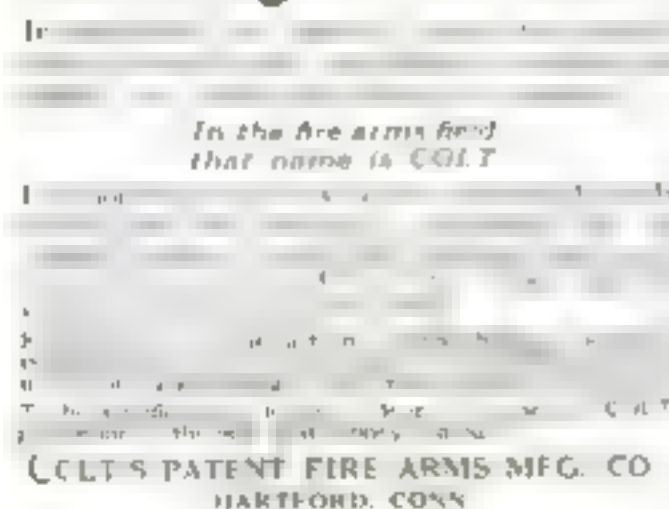
Champion Spark Plug Company, Toledo, Ohio

Champion Spark Plug Company, of Canada, Ltd., Windsor, Ontario

Protection



**"The Best that
Money Can Buy"**



COLT'S

FIRE ARMS

central, so as to be in line with the bottom of the V-slot that is milled on the under side. The angle of the V-slot may be 45°, but any other angle will do as well. If the material from which the jig is made will allow it to be hardened, this process will make it very much more serviceable. In use, the drill is run through one of the holes in the jig that is of proper size, and the point of the drill is placed in the center-punch mark on the work. Then the block is clamped tightly in place and drilling is accomplished with accuracy.—J. A. WEAVER.

Washing Your Car in the Approved Way

NO automobile owner should forget that unusual care must be taken in washing a new car during the first few months of use.

The best of varnish requires considerable time to harden, and until that time the finish is easily scratched. Only pure castile soap or non-alkali soaps should be used for the removal of grease. Gasoline is out of the question.

Lukewarm (not warm) water should be used in washing, and accumulations of mud or dust should be carried off by means of a six-inch stream of water from the hose, instead of being rubbed off with a sponge.

After a thorough rinsing, the varnish should be dried by means of a chamou-



The body of an automobile must be carefully washed and cleaned, otherwise it will lose its beautiful finish.

skin wrung out continually in clear water. A long straight sweeping movement of the chamouis produces better results than a rotary motion.

A soft woolen duster is preferable to a feather-duster for the interior of the car.

Plate-glass windows are best cleaned with soapy water to which a small amount of alcohol has been added. Rinsing may be done in the usual way, the chamouis being used to take up the moisture remaining on the car body, first making sure the chamouis is free from grit.

Wax polishes have been on the market for a number of years and their application is a simple matter. A piece of clean cheese cloth is used in applying the wax and another to distribute it evenly.—R. L. PRINDLE.

The shoes men are buying for summer comfort

Many new types for outing and everyday wear

AT THE seashore or in the mountains—on the street or at the tennis court—wherever you go this summer you will see Keds.

These light, springy canvas shoes are ideal for work or play in warm weather. Their elastic rubber soles put new life in your step. Their soft, pliable fabric makes them always cool and comfortable.

Keds are just the thing for games or any kind of summer wear. They allow the foot full freedom with just the right support. They always give a perfect grip, whether you are playing a fast set of tennis or standing on the smooth deck of a motor boat. It is because of these features that Keds are so popular for every vacation need.

Other types of Keds

Besides these standard types Keds are made in many special models for different purposes—high shoes and low shoes, with or without heels, in many weights, shapes, and colors. There are sturdy work shoes, light gymnasium shoes, and heavy reinforced models for hiking and rough service.

Some of the latest models are made just like leather shoes, with regular welt construction soles and firmly boxed toes. This means a more formal, dignified shoe—just the shoe you have needed to wear with your white flannels or Palm Beach suit.

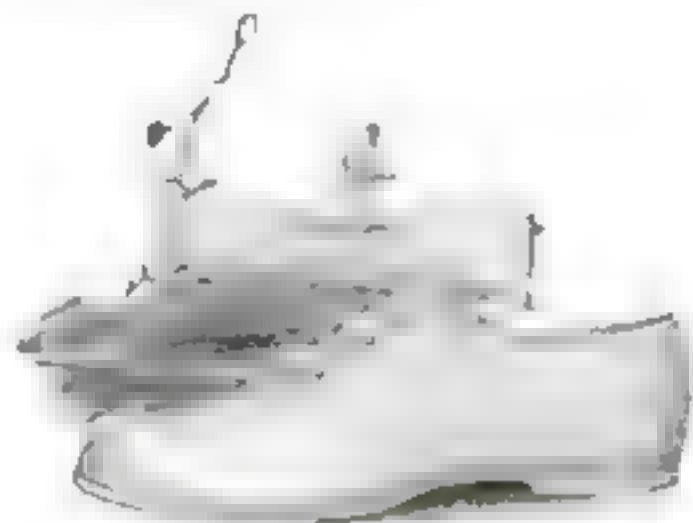
With these additions, Keds are now a complete line of canvas summer shoes—ranging from the easy, less formal tennis shoe to the latest and most fashionable styles of footwear. Last year millions of pairs of Keds were worn by men, women, and children.

Keds are made only by the United States Rubber Company—the oldest and largest rubber organization in the world. You will find them at every good shoe store. Ask to see the various models—notice how wonderfully light, cool and comfortable they are.

Look for the name *Keds* on the sole.

For men and women \$1.50 — \$6.00

For children \$1.15 — \$4.50



The standard shoes for tennis, boating and vacation wear. Made of light canvas, in high or low models—white or brown—with black, gray, or red rubber soles.



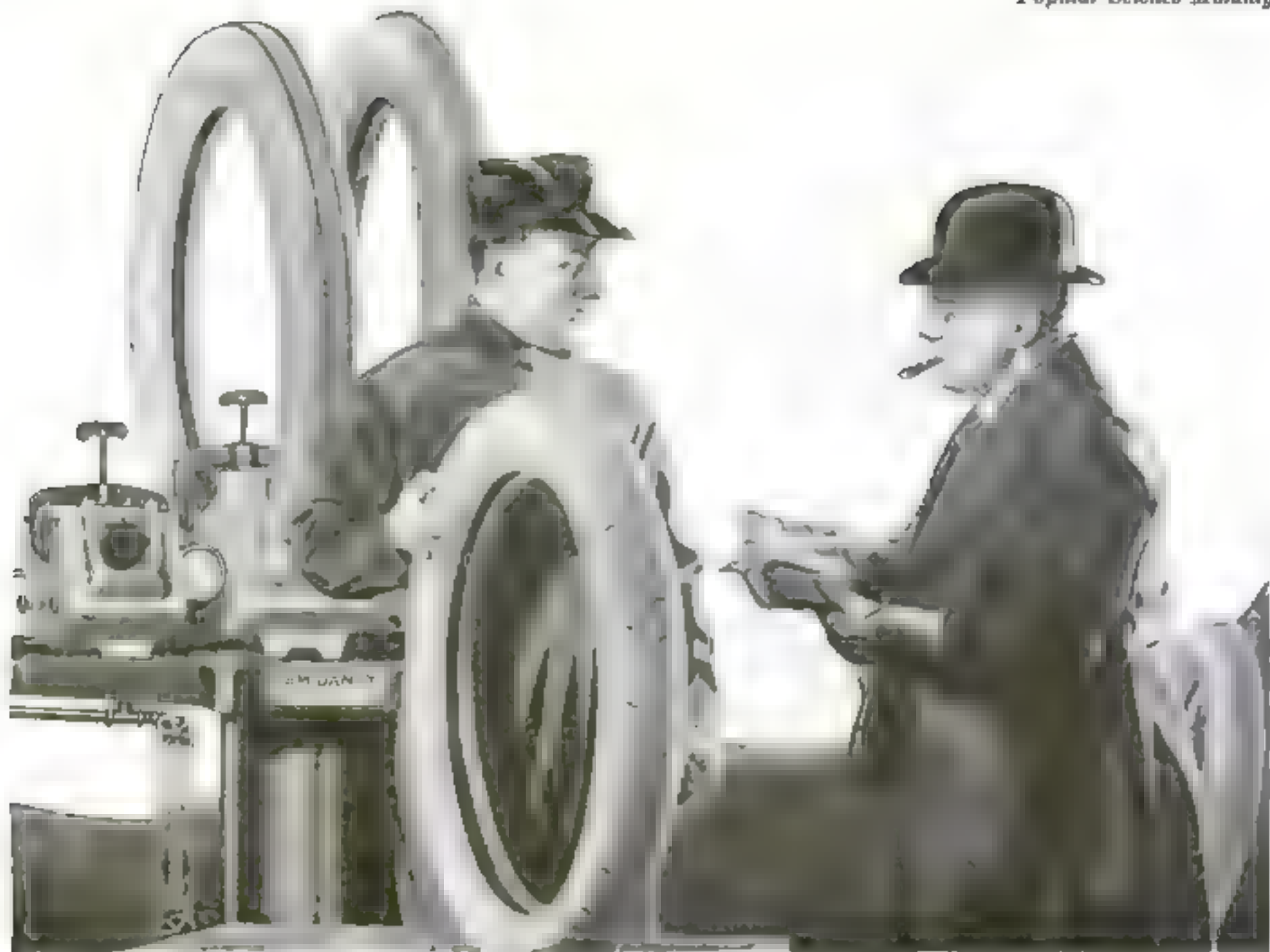
One of the smart special models for summer wear. Made of the finest white canvas—in high or Oxford models—with welt construction soles which give all the style of leather shoes.

Keds



Sturdy sport shoes—with or without heels. Made of heavy white or brown duck. Brown leather trimmings with white patch—red rubber soles and toe caps.

United States Rubber Company



Make Big Profits Repairing Tires

DO you want more money? Do you want to get into a fast-growing, uncrowded business where you can make from \$250 to \$500 a month the first year? Do you want to be independent? Do you want to share the profits in the richest industry in all America?

Of course, you do. Then investigate the tire repair business—and do it now. The Jim Dandy Tire Repair Plant is making money for many men. It can do it for you.

Fortunes have been made in all lines connected with the automobile industry—but none has ever offered greater opportunity than tire repairing with a Jim Dandy Plant offers you today. The tire repair men of America have a \$200,000,000 business ahead of them this year. Think of it!

By January 1st, 1921, there will be 40,921,076 tires in use in this country. Every one of these tires must be repaired some time. More tire repair shops are needed. Big, profitable business is waiting for them. Do you want it?

Business Is Going Begging

This is your opportunity. The tire repair industry needs business men of ambition and

ability. The field is uncrowded—the number of tires to be repaired is increasing at the rate of 40% a year.

As proprietor of your own tire repair establishment you will be dealing with the wealthiest and most prominent people in your community. These people will ask you for advice about tires, accessories, even automobiles—unlimited opportunities for profit will be yours.

And you will be in a business which is an absolute necessity to the community. Tire repair trade comes again and again. You will have a steady repeat business getting bigger and bigger every year.

\$250 to \$500 a Month

With your own Jim Dandy Tire Repair establishment you can make your income \$250 to \$500 a month or more depending on your energy and initiative. Many tire repair men who have done a business of \$250 the first month have increased to \$500 the third month. What these men have done you can do. They started like you and learned the business. Their success is not unusual.

Get started in tire repairing with a Jim Dandy plant and get started now. There will never be a better time to start.

Own Your Own Business—Be Independent

WHY depend on another man's business to make a substantial income for you?

Why not put your time and ability into your own tire repair business—then you will get all you earn. You can be independent just as well as the other men who own Jim Dandy Tire Repair Establishments. These men broke out of the rut, stopped working for somebody else—and started their own tire repair establishments.

We Teach You FREE

You can start a highly profitable business today with a few hundred dollars. One Jim Dandy Plant equips you—we teach you everything about tire repairing—how to start in business—how to get trade—what to charge—how to figure your cash profits. You can learn in one to three weeks—and be ready to make money.

It makes no difference what your present business is. You can make a success of your own tire repair establishment. You don't have to be a mechanic. Neither do you require a college education. Tire repairing is a business man's business. If you have the energy and the will to do, we can teach you in a short time.

We have had forty-one years successful business experience. Since 1879 we have been gathering the information and experience which help you make a quick start today. You understand, of course, that we give you our training and help without charge.

The men who have made big money are the men who have had the foresight and the nerve to break away from the crowd and strike out for themselves when they saw a chance for independence. Don't let a salaried position keep you from your chance to own your own business, be your own master, pocket your own profits. Many a "job" has kept a man from a bigger opportunity as an executive in his own business.

Your Opportunity

Haven't you often felt that you could manage the business you are in now, if you had the training and opportunity? Haven't you suggestions and ideas which you know would make bigger profits possible? Give yourself a chance to use these ideas where they will pay you.

In your own tire repair business you will have a chance to do the planning and give the instructions. In a short time you can have more work than you can do alone. Then you will have assistants to do the actual work, while you give your time and thought to the active management.

No previous training—no long apprenticeship—no large investment. You can get started immediately—open a shop—and in a short time you have more work than you can handle alone. Good tire repair men are badly needed. Your profits start the day you set up your Jim Dandy Plant.

There is no city too large or town too small for you to do a profitable tire repair business. To every 11 persons in the United States there is an automobile with four tires to be repaired. No matter where you are—what your age or occupation—in **one month from today** you can be making money from your own tire repair business if you start now. Let us prove it.

A Jim Dandy Tire Repair Plant makes it easy for you to learn the business and to turn out the kind of work that brings customers back again and again. It is the only tire repair plant on the market which uses super-heated steam. Perfect work is assured even when you are a beginner. You can make any kind of a repair—and you buy no unnecessary molds or parts. You do not pay for anything that will not bring returns.

The Jim Dandy has the largest capacity of any plant of its size on the market. It is fully guaranteed and backed by our long experience in the tire repair business. We have established tire repair businesses for men of many ages and professions in towns of 200 population and up and have no record of a failure. We are ready to give you every assistance.

Get The Facts By Return Mail

Investigate. Send the coupon below or a letter or postcard. This brings you full information—personal consideration and advice—and a big catalog. Tells all about the tire repair business. How you can make money—be independent.

By return mail you can have all the facts before you. You might as well make \$5000 a year. It is up to you. You know you want it. Then investigate. Use the coupon below.

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Established 1879

St. Paul

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JIM DANDY
TIRE REPAIR PLANT

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FREE INFORMATION COUPON

Scheffer & Rossum Company,

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Gentlemen: Please send full information about how I can start in the tire business with small capital and make a good income. Also your **free** book entitled, "Your Opportunity."

Name

Address

How to Make a Stepless Transformer

Home electricians need not blow fuses

By H. H. Parker

AT first thought, a transformer which steps the voltage neither up nor down would appear to be a useless contrivance, but the little

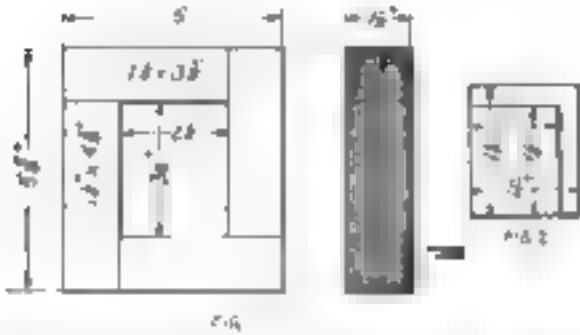


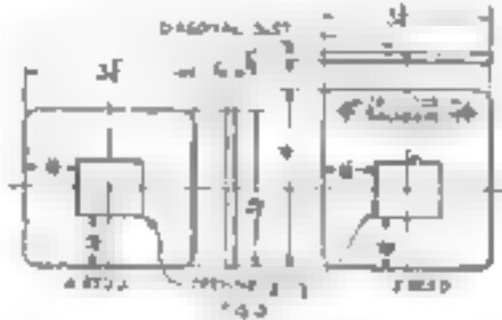
Fig. 1 gives dimensions of the sheets; enough to make one pile. If iron is used the core can be made smaller, as in Fig. 2

apparatus shown in the drawings is designed to act as a safety valve for the experimenter who likes to manipulate his alternating-current house-lighting circuit and who is continually blowing fuses. The transformer will deliver 110 volts at the secondary, and 3 or 4 amperes for intermittent work.

In experimenting, the secondary terminals may be shortened as often as one pleases without affecting the house-circuit; moreover, the coils may be connected in series and the device used as an auto-transformer, delivering 220 volts at the series terminals. If the primary voltage is to be 220, each coil should be wound with twice the number of turns, or 1120, using smaller wire, such as No. 20 d.c.c.

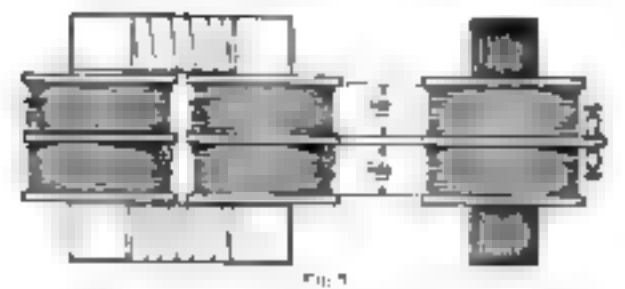
The core is built up of 1 1/2-in. sheets of "stove" iron, which should be as thin as may be obtained. The dimensions of the sheets are given in Fig. 1.

Enough sheets are used to make a pile 1 1/2 in. thick, though if transformer iron were used the core could be smaller in cross-section (Fig. 2). Make some flanges out of 3 16-in. red fiber, as shown in Fig. 3; pile up the sheets forming the core legs, with alternate ends overlapping 1 1/4 in.; clamp them tightly together, and force the flanges over them. If there is any looseness, force more into the pile, but have exactly the same number in each leg. Then wrap the winding spaces, 13 16 in. in length, with insulating tape and start the winding, after an inch or two of the wire has been pushed through the slot in the center flange.



The flanges are made from 3 16-in. red fiber as shown in Fig. 3. Make sure that there are an equal number of flanges in each leg

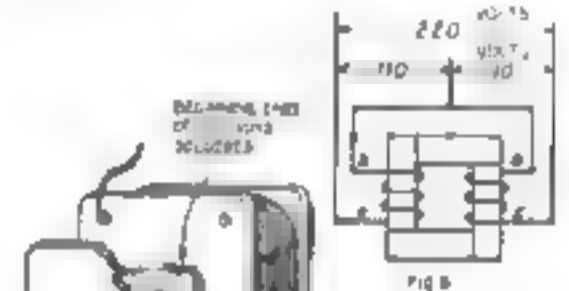
Use No. 16 d.c.c. copper wire; there will be 280 turns in each section, twenty turns per layer, and fourteen layers. Attach the outside end to one of the corner binding-posts and begin winding the second section by soldering the wire to the projecting inside end of the first section. Insulate the joint well and wind on 280 turns in the opposite direction, making 560 in all.



Here is the complete transformer. Make sure that all connections are correct before it is hooked up to the source of current

Wind the second leg in exactly the same way; soak the coils in shellac or insulating varnish and bake in an oven. Fig. 4 illustrates this winding process: the method allows both coil ends to come on the outside of the winding, and furthermore, the center flange serves to hold the laminations tightly together. Next push the yoke sheets into place, tapping with a light hammer if necessary and bind with friction-tape. Fig. 5 shows the complete transformer and Fig. 6 the auto-transformer hook-up.

The apparatus is intended to operate at the usual frequency of 60 cycles; a lower frequency would require a larger core or a greater number of turns in the winding.



This illustrates the winding up process

This illustration shows how the auto-transformer is hooked up

A Paint-Spraying Device that Saves Effort

PAINTING automobile radiators with a brush is a long and tedious job. If the paint be applied too thick, the function of the radiator is badly impaired; if it be applied too thin, the finish will not last.

Where much painting of this kind is needed a very satisfactory job can be done with a simple and practical spraying device that can be made by anyone. It consists of

elements, of which two sizes and designs are shown in the illustrations. A can to contain the paint has a hollow cylindrical handle *A* extending at right angles to the side; through it passes a smaller tube *B* that extends to the other side of the can and above the main body section. A second part, or section *C*, is placed vertically. Its lower end is close to the bottom of the can,

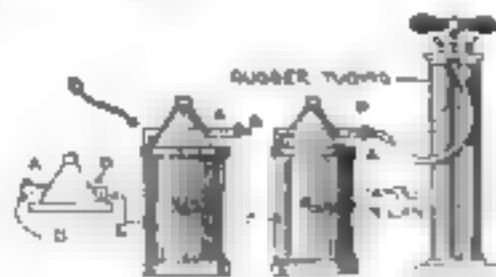
and its upper end is at the extremity of the horizontal tubes *B* and *C*, as indicated by the dotted lines.

This is a simple adaptation of the siphon principle with which everyone is familiar, and of which the best exemplification is the atomizer, used in the home. Air is forced through tube *B* in the

this device must be fairly thin to secure the best results. When painting the radiator, tilt it slightly forward so that the paint may drain from the cooling cells.

Another paint-spraying arrangement can be made by combining a kerosene-can and a tire-pump. The can should be of 1/2-gal. capacity. The handle may be arranged either horizontal or vertical as desired, but the siphon should be made from two brass pipes fixed at right angles, one

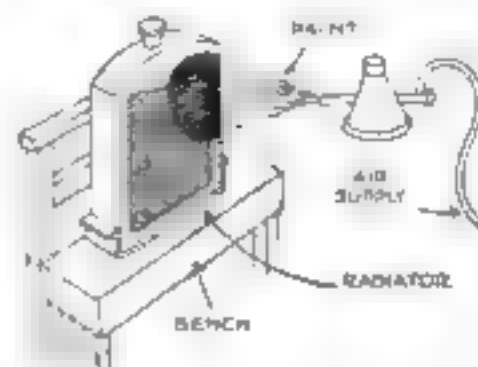
to extend horizontally through the top of the can to afford stability, the other to pass vertically from the top of the can nearly to the bottom. At the tube on the outside of the can there is provided a coupling which receives the tube of the tire-pump, which is operated as usual. -R. L. PRINDLE.



Here are shown the various components of the paint-spraying apparatus

handle, directly across the upper end of the vertical tube *C*. The liquid inside the can is drawn upward through the tube and sprayed over a wide area.

The mixture of paint used with



The paint from the nozzle goes in a thin cloud to all parts of the radiator

The Imprisoned Rainbow

**To most of us a lump of soft coal
is merely a source of heat**

BUT the chemist sees in it illuminating gas, coke, coal tar, and its by-products, awaiting only the application of heat refining processes to release a beautiful rainbow of colors from its dungeon of darkness.

Four thousand years ago, long lines of camels crossed the desert bearing splendid cloths of purple, red and indigo, dyed in primitive fashion with colors obtained from roots and herbs.

But today, Milady, whether she lives in Mena, Arkansas, or New York, can be just as gorgeously arrayed as were her sisters in Bagdad, thanks to the chemist's magic and to temperature indicating, recording, and controlling instruments perfected by science. For in the distillation and refining processes used in obtaining beautiful aniline colors from coal tar, heat must not only be accurately known but *controlled*.

In scores of the largest and most modern chemical laboratories and dye works *Tyco* Temperature Indicating, Recording and Controlling Instruments are used because of their *dependable accuracy*. Just as they are used in hundreds of other industries.

There are over 8,000 different types and styles of *Bios* instruments, from the delicate fever thermometer for taking body tempera-

ture to the Fery Pyrometer accurately recording thousandths of degrees of heat.

At the right we list *Howe* Instruments for the home. Ask your dealer about them. If he won't supply you, write to us direct sending dealer's name. Literature concerning any instrument in which you may be interested will be mailed promptly upon request. Let the recipient decide as to its value and instructiveness.

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**There's a
Lyco and Taper Thermometer
for every purpose**

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Ask Your Dealer)



Safety stamps— do you know what they are?

One rarely hears of an electrical fire nowadays.

Thank the safety stamps for this condition, remarkable when thousands of horsepower in electric current is carried over wires, through motors, lights and countless devices of all sorts.

But then, for a long time now electrical materials have passed before a wise censorship—the National Board of Fire Underwriters.

Originally a joint committee of insurance companies, they have outreached their first reason for being and have become a sort of inspirational bureau of standards for all manufactured electrical goods and for electrical construction practice.

They must approve every specialty device and circuit in your home or business property.

They personally inspect all installations so that your electrical work shall be safe from fire risk, and that insurance rates may be minimized.

The Underwriters' safety stamp or written approval is a basis for confidence in things electrical.

Twenty years ago electricity was a mysterious, untrusted, fearsome thing.

But who fears it today?

Not mother manipulating the morning toaster. Not the lineman on the pole. Not even the children around the Christmas tree with their electrical train.

The Underwriters have preached electrical safety—worked to make it practical and, as you will admit, have succeeded.

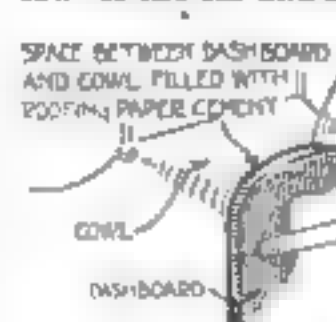
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interest of Elec-
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by whatever helps
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Western Electric Company

No. 6 Visualize a catalog seven inches by ten, with each of its 1100 pages devoted to listings and information on electrical devices and materials. This will give you some idea of the many-sided activity of this Company in serving the public's electrical needs.

Ford Owners May Safely Go Out in the Rain

PROBABLY there is not one Ford owner out of a hundred who has not, at some time or other, been unable to start his engine because the rain has driven in between the dash and the cowl of the car and short-circuited the



No more dread of rain-storms and shorted coils if you adapt this waterproof device for your Ford

wiring back of the coil-box. This is a common occurrence and the owner has finally to resort to a waterproof cover to protect the opening during wet weather.

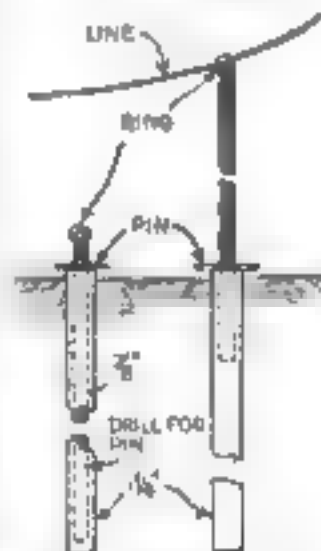
One way to cure this nuisance is to fill

the space between the cowl and the dashboard, as indicated in the sketch, with the thick black cement which comes as part of the equipment of every roll of roofing-paper.

If the cement is thick from cold weather, warm it until it will flow, and then pour it in a small stream the full length of the seam. The cement will set in a very short time and is a sure cure for the leak.

A Disappearing Clothesline- Pole for Your Yard

TO save space and improve the appearance of the back yard, it is well to have disappearing clothesline-poles like the one shown in the diagram. A length of gas-pipe is sunk to a depth of 6 or 7 ft. and a smaller one is made to telescope into it, forming the pole proper. The outside pipe is 1½ in. in diameter; the other, ½ in. The larger pipe should project 2 or 3 in. above the ground to prevent material from working down into it and clogging the end.



Two holes are bored in the smaller pipe, which takes a small round iron pin to keep it from falling out of sight, and to hold it up to its position when in use.

When your clothes-poles are not in use, this device enables you to drop them into the ground out of the way

To prevent accidental dropping of the pipe, however, the smaller pipe may be 2 or 3 in. longer than the casing, so that, even when it is dropped it will still extend out of the casing.

The top of the pipe-pole is provided with a looped iron rod to take the line when it is passed through it, as shown in the diagram.—DALE VAN HORN.



United States Army Field Radio Section

Where Compactness is Vital

WHERE every inch of space must be utilized and every superfluous ounce of weight eliminated, you find the compact, sturdy Corona doing a man-size job.

Thus its extraordinary compactness and lightness place Corona among the little giants of achievement. As in the modern thin-model watch which keeps perfect time and the pocket camera which makes sharp, clear pictures, so in Corona, inventive genius reduces size while it increases efficiency.

Costly office space, limited traveling quarters, high transportation charges, expensive and none too abundant clerical help—these and a score of other reasons have placed Corona in the hands of over 200,000 users who value it for its unfailing usefulness, its retiring disposition when not busy and its enduring toughness under heavy duty.

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Weights a trifle more than 6 pounds, travels in its own snug carrying case, does standard typing—your choice of elite or pea size type. Folds up like a book. Price \$50 with case. Booklet on request.



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Electricians' Wiring Manual

By F F SENGSTOCK, E. E.

Formerly ELECTRICAL INSPECTOR,
Chicago Board of Underwriters



Its Value to You

TO WIREMEN and THE APPRENTICE. It places in your hands compact practical instructions applying to any sort of light or power installation in strict accordance with the National Electrical Code. Illustrations are given by showing how to avoid it. The apprentice by following its directions may become an efficient wireman, able to give off-hand, reliable installation data.

ELECTRICAL CONTRACTORS will find it a book to place in the hands of their workmen, and one that they will appreciate because it explains what they want to know without technicalities, and further it gives them the idea of how to do the work from an electrician's point of view, one thing the contractor wants. It gives valuable estimating data and standard forms and gives bearings used by contractors having long experience.

BUILDING ENGINEERS and MAINTENANCE MEN often called upon to do odd jobs of wiring, you will appreciate the value of this book. It will forestall you against any mistakes and enable you to tackle anything in this line of work.

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CONSTRUCTION OF SMALL ALTERNATING CURRENT MOTORS. By A. E. MAXIM. This book contains complete instructions for building small alternating current motors in several sizes. The designs will be found in harmony with those of the very best manufacturers and they can be worked out by the amateur for making useful instruments. Fully illustrated. Price postpaid, \$1.25.

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COMPLETE PRACTICAL MACHINIST. By JONAS RUM. One of the best-known books on machine shop work, and written for the practical workman in the language of the workshop. It gives full practical instructions on the use of all kinds of metal-working tools, both hand and machine, and tells how the work should be properly done. It covers lathe work, vice work, drills and drilling taps and dies, grinding and centering, the making and use of tools, tool grinding, making out work, machine tools, etc. No machinist's library is complete without this volume.

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ARMATURE WINDING. By DAVID P. MORRISON. This book covers the theory of armature winding and the practical application of these principles to the winding of various types of armatures. The book is profusely illustrated with wiring diagrams and photographs of coil winding apparatus and is a thoroughly modern treatment of the subject. Partial table of contents: DIRECT CURRENT ARMATURES. Development of the Electromotive Force Equation. General Construction of Armatures. Ring Windings. Lap Windings. Wave Windings. Armature Construction. Commutator Construction. Forming Armature Coils. Winding Armatures. Impregnating and Insulating Windings. Binding Wires, etc. ALTERNATING CURRENT ARMATURES. Development of Electromotive Force Equation. Single Two and Three-phase Winding. Delta and Star Connections. Open and Closed-Circuit Windings. Single and Multiple Circuit Windings. Lap Windings. Wave Windings. Chord Windings, etc. Methods of Reconnecting a Winding for Different Voltage, Frequencies or Number of Poles. Price postpaid, \$2.25.

Book Dept. Popular Science Monthly
225 West 39th Street, New York

Measuring Angles with a Watch

By Windsor Crowell

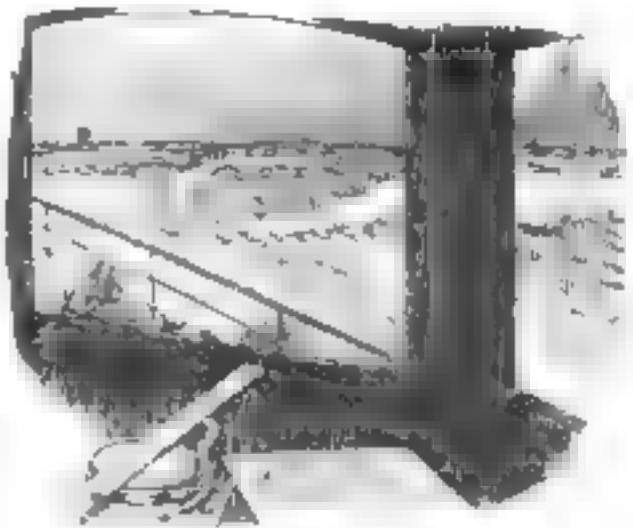
FEW persons realize that rough surveying can be done with a common watch, but such is the case.

By means of this always available instrument, approximate direction and angles can be determined in a few moments, and the uncertainty of location and travel somewhat overcome. This is valuable in desert, ocean and prairie travel.

A watch-face is divided into 12 major sections, indicated by the hours from 1 to 12. As the complete circle consists of 360°, each major section from one numeral to the next would be 1/12 of that, or 30°. Then again, each space between numerals is further divided into 5 equal parts, or minutes, each one of the minutes representing 6°. With this in mind it will be easy to approximate angles.

Suppose, for instance, you are at sea in strange waters and have lost your bearings. You want to find the

case it comes directly over the numeral 4. Then, as there are exactly 3 major sections included in the space between



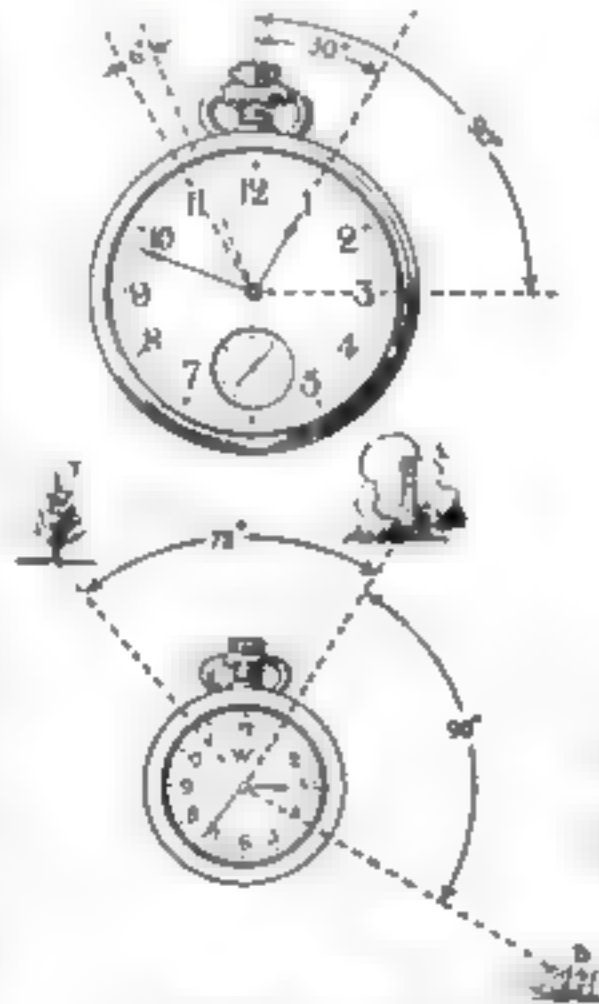
Suppose you were a pilot and the lightning injured your compass. Could you get your bearings with a watch?

1 and 4, and each space represents 30°, the angle LWB would measure 90°.

Suppose you want the angle between the lighthouse and another point on the land, represented by the tree T .

Take the two directions in the same way, pointing numeral 1 towards one landmark, such as the lighthouse L . This time the straight-edge cuts the dial when pointing towards T , so that it comes between two numerals and lies over a minute-mark between numerals 10 and 11. Simply add the space between numerals to the space between the remaining minutes. Thus, the space between 1 and 11 represents 60°, and that between 11 and the second minute-mark represents 12°. Their sum is 72°, and means that the angle LWT is 72°.

To any one with a meager knowledge of geometry or trigonometry, the finding of resulting distances and directions is a simple matter and some day may stand him in good stead.



Only a slight knowledge of geometry is necessary to use these novel methods of measuring angles.

angle between the light house L and the distant ship B . Then by determining other angles, you will try to ascertain your distance from land. The matter in hand, however, is to find the angle LWB .

Take out your watch and lay it down level, the numeral 1 pointing to the lighthouse L . A straight-edge, laid across the center of the watch and the numeral 1, and in line with the distant object, will give fairly accurate pointing. Then, leaving the watch in the same position, find where the straight-edge cuts the dial when pointed towards the becalmed ship B . In this

Weighing Poultry or Produce on Homemade Scales

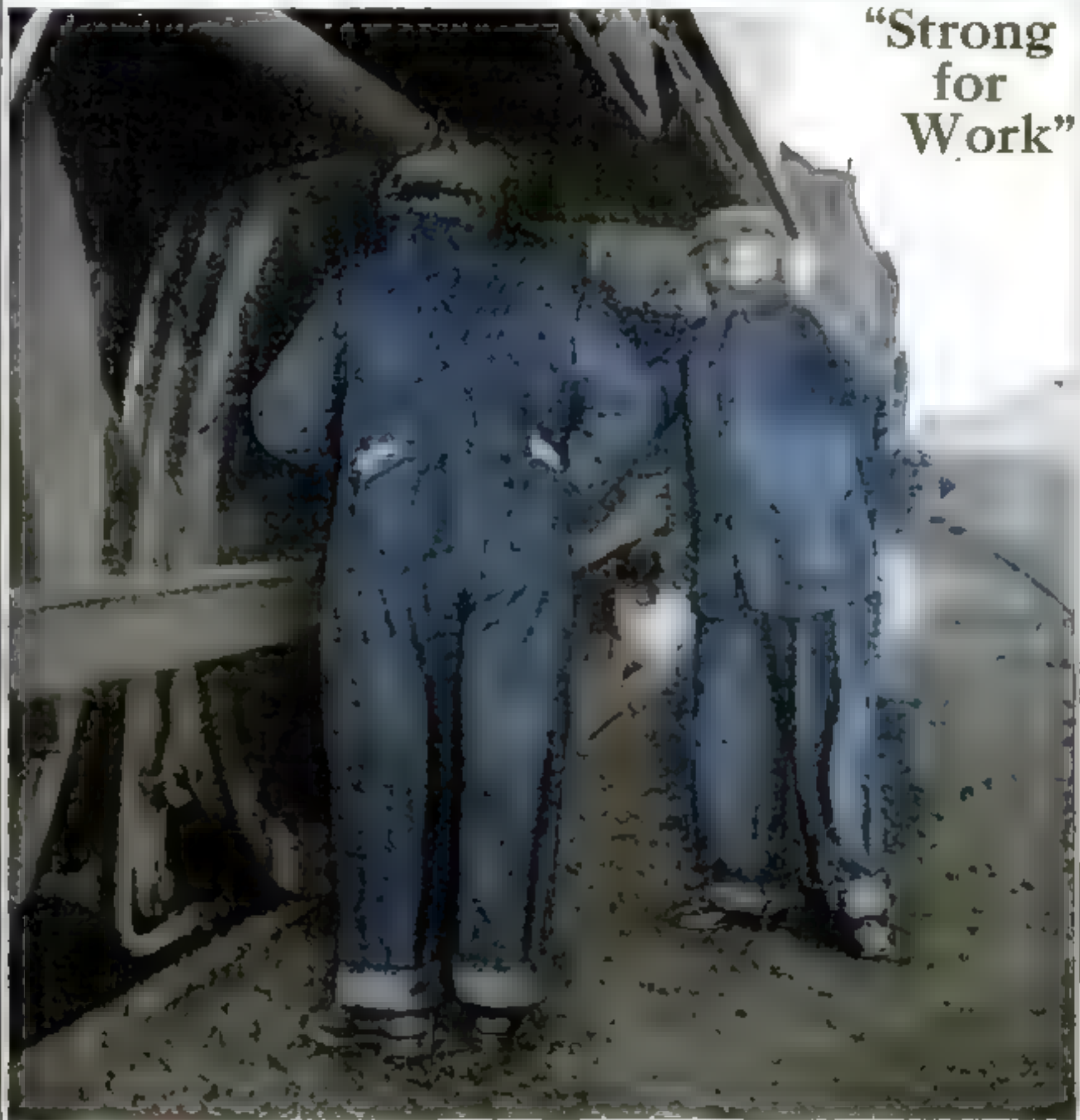
A CONVENIENT set of scales that will take the place of both the spring- and the beam-scales is herein described and illustrated. It can be built by any amateur mechanic in a few hours and at practically no expense. The principle is that of lifting a suspended weight by leverage, therefore there are no springs to weaken or weights to lose.

Erect a piece of wood, 2 in. by 4 in. vertically upon a 1-in. plank about 2 ft. long by 1 in. wide. The standard erected should be about 2 ft. high and have a smooth finish.

Then cut out a lever from oak or other heavy, close-grained wood, making it of about the shape illustrated. The top edge must be about 6 in. wide, and the bottom edge, about 15 in. or 18 in. wide. This forms a wedge-

Blue Buckle Overalls Union Made

**"Strong
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Work"**



"Tuning up" one of the world's largest passenger locomotives for a run on the Atlantic City R. R.



More quality, more comfort and more durability are put into every dollar's worth of Blue Buckle Overalls and Coats than you ever before found in a work suit.

Each garment squares up to the Blue Buckle standard—the finest work-rig in America! Test the strength of Blue Buckles' staunch indigo-blue denim;

the riveted brass buttons; brass clasps; the non-splitting reinforced back band; suspenders scientifically cut to stay up on the shoulders! Together with the flawless Union workmanship, these features insure the utmost in wear and comfort your money can buy.

Know the satisfaction of doing a job in the best togs obtainable. Blue Buckles will delight you!

JOBBER OVERALL COMPANY, Inc., Lynchburg, Va.
Largest manufacturers of overalls in the world



Oh! it's the magic Figure 8

NO wonder they are all crowding around! They all know that it's the magic figure 8 that makes the 1900 Cataract Electric Washer the perfect washing machine.

The figure 8 means that the hot sudsy water is forced through the clothes in a figure 8 motion and *four times* as often as in the ordinary washer.

Then there's the planished copper tub—not a part in it to rub and wear the clothes, pull off buttons, or tear out button-holes! And when you've finished the wash, there are no heavy cylinders to lift out and clean.

The wringer also works electrically and is movable. You can swing it from washer to rinse water, to blue water, to clothes basket without moving or shifting the washer.

The 1900 works quickly too and costs less than 2c an hour to operate. And it washes a whole tubful of clothes spotless and clean in 8 to 10 minutes.

The water swirls through the tub in a figure 8 movement four times as often as in the ordinary washer.



Time in 8
and 10
minutes

Our Special Trial Offer

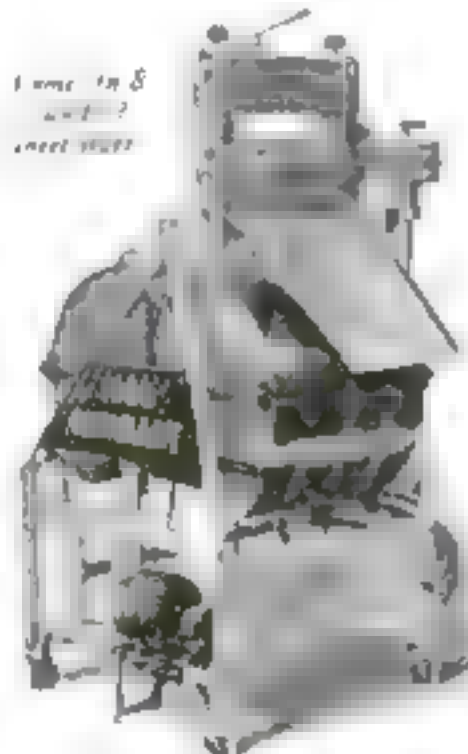
You may prove to yourself that the 1900 is the perfect washing machine. There is a 1900 dealer near you who will gladly demonstrate a 1900 Cataract Washer right in your own home. Then if you wish you may start paying for it on terms to suit your convenience. Remember, we also have washing machines operated by hand and water power.

Write to us today for the name of the nearest 1900 dealer, and a copy of the book, "George Brinton's Wife." It's a story you will enjoy. Molly, his pretty little wife, had troubles of her own until she interrupted a bridge party, and then things began to happen.

1900 Cataract Washer

1900 WASHER CO.
206 Clinton St., Binghamton, N. Y.

Canadian Factory and Office:
CANADIAN 1900 WASHER CO.
267 Yonge St., Toronto



Just connect it with the electric light and off it starts.

1900 WASHER CO.
206 Clinton St., Binghamton, N. Y.

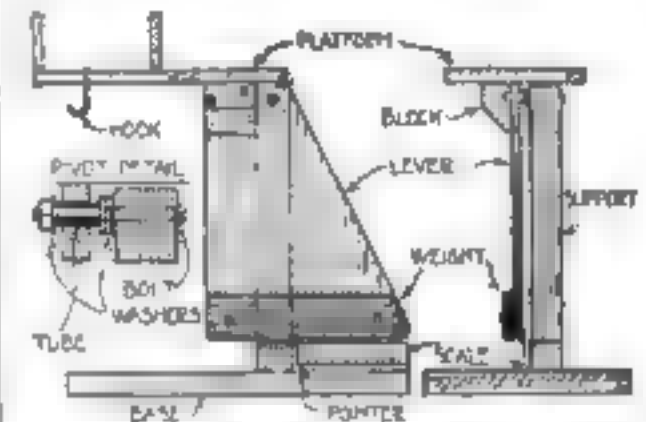
Please send me the name of the nearest 1900 dealer, and a copy of the story, "George Brinton's Wife."



NAME _____
ADDRESS _____
CITY AND STATE _____

shaped piece; one edge of it should be perpendicular to the bottom. This is the front. Pivot this lever to the supports with a bolt, as shown in detail, so that it will swing freely and well clear of the standard.

A platform of 1 in. board, 2 ft. long and 1 ft. wide, is then fastened to the top edge of the lever with screws. Two blocks underneath, fastened to



This set of home-made scales takes the place of both the beam- and the spring-scale. It can be made for almost nothing.

the lever, help steady it. Two upright partitions should be set on the platform to keep the goods which are being weighed from rolling off. A hook underneath will serve to hang things on.

Next apply sufficient weight to the bottom of the lever so that the front edge will be brought as nearly as possible parallel to the edge of the support.

Make a scale of cardboard, and set it edgewise upon the base in the position shown. Also, set a pointer of stiff wire on the back surface of the lever which will come down in front of the scale without touching it.

To calibrate the scale, set known weights upon the platform, and mark along the scale just where the pointer comes, ounce for ounce, or pound for pound, as the weights are increased. Thus you will always have a fixed scale, and springs or lost weights will not vary it.

Give the whole scale a coating of shellac or varnish to keep out the dampness. Fasten the base to a table or bench, so that heavy loads will not tip it over.—L. B. RUBINS.

Taking the Dents Out of a Gasoline-Tank

VERY often an automobile comes into the garage with its gasoline-tank dented, the result of a rear-end collision, or perhaps of backing into a pole or post when the car was about to be parked. While dents do not prevent the proper functioning of the gasoline system, they are nevertheless un-ightly and detract from the neatness of its appearance. They can be removed by the following method.

Make a pull rod A and end pad B as shown in the illustration, and scarf the edge C. Solder the lower end of this tool right on to the metal of the tank in the center of the dent as shown at D. Cap the tank, apply a



New Lessons in Shaving

Hot towels and finger rubbing
not needed. The secret
of softening the beard
lies in emulsifying the
oil coat on the beard.

What Science Has Done to simplify shaving

Several years ago we began to make shaving a study in the Palmolive Laboratories.

We were certain there was a scientific way to make each hair cut easily, and we sought to find it.

We studied the beard. We learned that the obstacle in fitting the beard for the razor was the oil that coats every hair of the beard. This oil, we found, did not yield as it should to the ordinary lather. Hence it was difficult for water to penetrate and soften the beard. As a result, men had to apply hot towels or rub with the fingers.

The solution

The solution to the problem, we knew, lay in a different lather than men were using. And we spent months experimenting with preparations. We tried 130 formulas before we achieved our Palmolive formula and mastered the last remaining problem.

And that men may know what a difference it makes in shaving we are offering a trial tube free.

See how easy

With Palmolive you need no hot towels or rubbing to soften the beard. You just put a bit of the cream on the face whisk it up into a lather, and your beard is ready for the razor! This is because Palmolive instantly emulsifies the

oil coat on the beard; so the water penetrates quickly.

And such a shave as you enjoy with Palmolive! You never dreamed a razor could glide so smoothly over the face. This is because this lather also lubricates the skin, so the razor can't scrape or irritate.

Both lather and lotion

Palmolive contains both Palm and Olive oils. Thus it is a lotion as well as a lather. It gives the skin a satin smoothness, a delightful cool "after feel" when shaved. No other applications are necessary.

Try it free

Note the coupon here. It brings you a trial tube of Palmolive Cream free and postpaid.

Try a Palmolive shave and see what an amazing difference.

Note that you don't have to re-lather with Palmolive, because it stays moist and foamy 10 minutes. A mere bit is ample for a shave. For Palmolive multiplies itself in lather 250 times. There's enough for 152 shaves in our 35c size. A cream so active, as you know, is something decidedly new.

But don't accept our word for the wonders of Palmolive Cream. Be the judge yourself, at our expense. Use a trial tube free. Send for it today.

Large size tube at druggist's, 35c

Free—A trial tube

Free yourself from old-time shaving fogs. Know how quick and easy and pleasant shaving can really be. A trial tube of Palmolive will prove a revelation to you. Send for it today. No charge. Simply mail the coupon.



For a free trial tube

The Palmolive Company,
Dept. 104, Milwaukee, U. S. A.

Please send me a Free Trial Tube
of Palmolive Shaving Cream.

THE PALMOLIVE COMPANY
Milwaukee, U. S. A.



40 minutes' use Shows the way to whiter teeth

All statements approved by high dental authorities

This test requires four minutes daily for ten days. To millions it has brought a new era in tooth cleaning.

The glutens teeth you see everywhere now should lead you to learn the way.

That cloudy film

Teeth are clouded by a film. By a viscous, ever-present film. You can feel it with your tongue. Modern research has traced most tooth troubles to it.

Film clings to teeth, enters crevices and stays. If not removed it hardens. The ordinary tooth paste does not dissolve it so much escapes the tooth brush. Thus well-brushed teeth by millions discolor and decay.

It is the film-coat that discolors, not the teeth. Film is the basis of tartar.

It holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay.

Millions of germs breed in it. They, with tartar, are the chief cause of pyorrhea.

The new method

A dental cleaning removes the film-coat, but that is periodic. The need was for a daily film combatant and science long has sought it. The way has now been found. Able authorities have proved its efficiency. And now leading dentists everywhere are urging its adoption.

An ideal tooth paste has been created to meet all modern requirements. The name is Pepsodent. And this new film combatant is embodied in it.

A quick convincing test

We now supply to thousands daily a quick, convincing test. And we urge every home to make it.

Pepsodent is based on pepsin, the digestant of albumin. The film is albuminous matter. The object of Pepsodent is to dissolve it, then to day by day combat it.

But pepsin must be activated, and the usual agent is an acid harmful to the teeth. So this method long seemed barred. Science, however, has discovered a harm-

less activating method, so active pepsin may be daily used on film.

Send the coupon for a 10-Day Tube. Note how clean the teeth feel after using. Mark the absence of the viscous film. See how teeth whiten as the film-coat disappears.

Compare your teeth now with your teeth in ten days. Then decide for yourself the way to beauty and to better protection. This test is most important. Cut out the coupon so you won't forget.

Pepsodent PAY OFF
REG. U.S.

The New-Day Dentifrice

A scientific film combatant combined with two other modern requisites. Now advised by leading dentists everywhere and supplied by all druggists in large tubes.

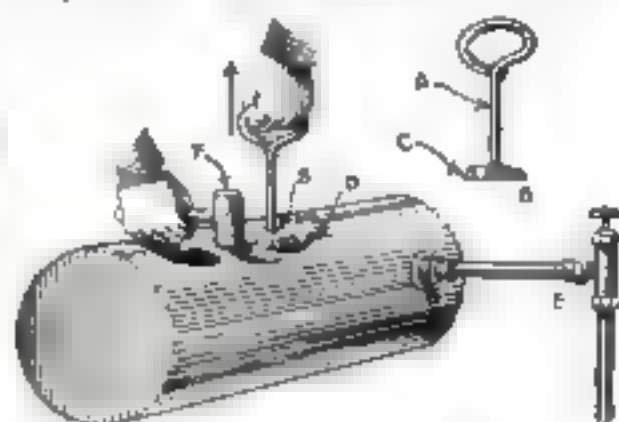
10-Day Tube Free

THE PEPSODENT COMPANY,
Dept. 476, 1104 E. Wabash Ave.,
Chicago, Ill.

Mail 10-Day Tube of Pepsodent to

Only one tube to a family

hydrostatic pressure from the water line E, and, while pulling upward on the tool, hammer all around the circumference of the dent, as F. It will respond to this treatment and when



Rear-end collisions are unavoidable and usually they dent the gasoline tanks. Remove them as illustrated.

the dent is pulled out, the solder can be melted and removed and the tank given a coat of paint, which will restore it to its original luster.

A Quick Method of Lining Up Lathe Centers

MANY a mechanic, if asked to line up the centers on a lathe, will invariably place the live center and dead center in their respective places, run the tailstock up close to the live center, secure it, and then run the dead center out until it just touches the live center. He takes a squint at their points and if they are apparently the same, he declares the lathe to be in A1 condition.

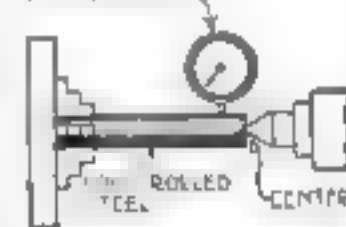
At its best, this method is only a makeshift depending a great deal on the condition of the center points: the sharper the center points are, the more dependable is the test.

By adopting the following method the alinement of the lathe centers can be determined to within 0.0005 at any point on the bed of the machine.

Place a piece of 1 in. cold-rolled stock in the lathe-chuck so that it projects out about 8 in. After centering with a combination center-drill, peel the center. Now secure a dial indicator in the tool-post so that the point

will be directly over the center on top. Set the indicator at zero in tension on top of the stock near the end. Move up the tailstock and clamp it tight. Run out the dead center into the

DIAL INDICATOR FASTENED IN TOOL-POST



Lining up lathe centers is easy provided you know how to do it.

peeled center hole and watch the indicator.

If the lathe is not in line, the tailstock center will pull the piece of stock up or down, and the indicator will record the amount of error.

The tailstock center must be short and stubby, because if it projects out too far, the stock will move the center.

This same test can be applied at four different points—the top, the bottom, and sides.—J. J. MCINTYRE.



To Help the Eyes See More and Farther —in the Woods, the Air, on Land or Sea

THE eyes of man function at comparatively close ranges. Unaided, they limit his enjoyment of outdoor life to his immediate surroundings and restrict his usefulness in many operations.

But through optics he has gained other and far-seeing eyes to help his own. Binoculars are made to lift his horizon and broaden his landscape, to unveil Nature's inaccessible reaches, to expose hidden dangers of the deep.

On every vessel of our Navy, large or small, with our forces on land and our heroes in the air, the binocular made an unparalleled war record. And we were its chief source of supply, meeting our government's needs with more than twice as many binoculars in a week as we formerly produced in a year!

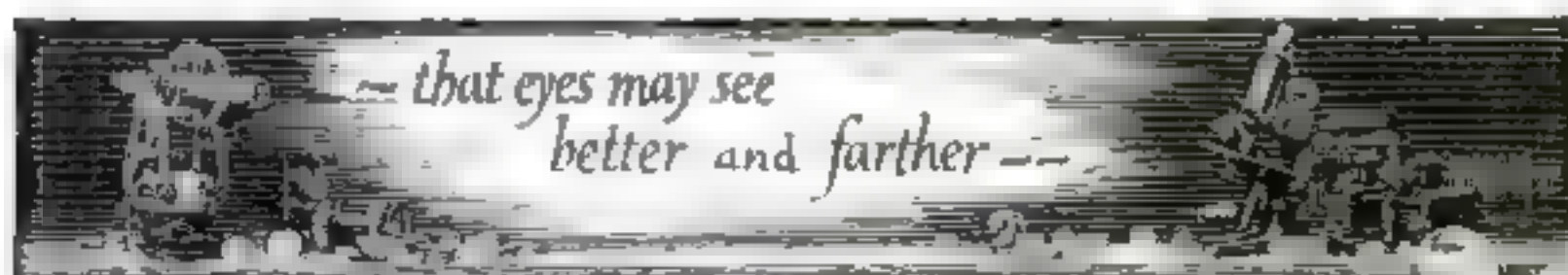
Now, in the ways of peace, the binocular is giving a service no less varied and helpful. What tourist does not multiply by many times the interest of his tours, when accompanied by his binocular? Tourist, aeroplanist, sportsman, yachtsman, Nature student—all depend upon it to increase their vision and their pleasure.

Nor is this the only optical product which adds to the comfort, safety and efficiency of life. The microscope, ophthalmic and photographic lenses, projection apparatus, military instruments and others combine to give a service to the world, which we are proud to have been developing along lines of precision and quality since the middle of the last century.

Write for literature on any optical product in which you are interested

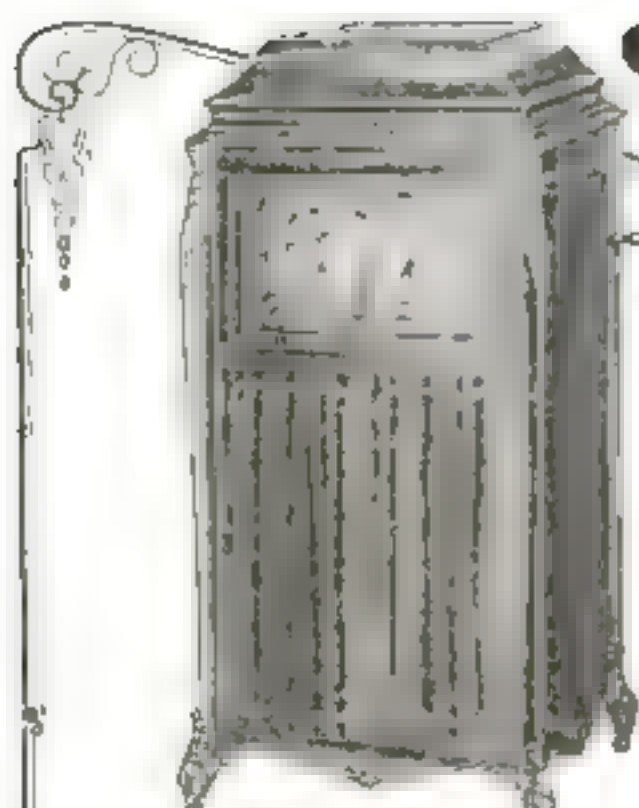
BAUSCH & LOMB OPTICAL COMPANY ROCHESTER, N. Y.

Makers of Eyeglasses and Spectacle Lenses, Photographic Lenses, Microscopes, Galileos, Binoculars and Engineering and other Optical Instruments.



Silvertone

**The Better
Phonograph For
Less Money**



Louis Quina Period Design.

Walnut or Walnut, Gold Plated Metal Parts.

Model XVI Price, \$195.00
Dimensions over all, 30 1/2 inches high,
24 inches wide and 18 1/2 inches deep.
Net weight, 125 lbs. plus 12 lbs.
packing. All inside metal parts
are heavily gold plated. An as-
sured point of service is
guaranteed.

\$6.00

A Month



**Louis Seize
Period Design.**

Walnut or Walnut, Gold Plated Metal Parts.

Model XV Price, \$175.00
Dimensions over all, 28 1/2 inches
high, 22 inches wide and 16 1/2
inches deep. Net weight, 105 lbs.
plus 10 lbs. packing. All inside metal
parts are heavily gold plated. An
assured point of service is
guaranteed.

\$5.50

A Month



**Louis Quina
Period Design.**

Walnut or Walnut, Gold Plated Metal Parts.

Model XI Price, \$145.00
Dimensions over all, 24 1/2
inches high, 20 inches wide and
18 1/2 inches deep. Net weight,
105 lbs. plus 10 lbs. packing. All
inside metal parts are heavily
gold plated. An assured point
of service is guaranteed.

Gold Plated

\$5.00

A Month

Send No Money

THE SILVERTONE Phonograph was designed and built to meet the demand for a good phonograph at a reasonable price. That it succeeded in fulfilling these requirements is proved by the fact that over two hundred and fifty thousand satisfied owners are unanimous in their praise of the SILVERTONE.

No effort or expense has been spared to make the SILVERTONE the best phonograph we could build. Experts in acoustics and mechanics have been kept constantly at work developing and perfecting new and better phonograph devices and mechanisms for use in the SILVERTONE. Skilled furniture designers have created cabinets worthy of SILVER. The quality of design, construction and design. None but the finest of woods and other materials enter into SILVERTONE Phonograph con-

struction, and they are fitted and finished with exquisite care and perfection. SILVERTONE quality is superior.

And we have kept the price of SILVERTONE Phonographs within the reach of all. Building phonographs in enormous quantities as we have to do to meet the requirements of our customers, we have enabled us to make the manufacture of our SILVERTONE Phonographs the very cheapest. And selling them direct from factory to customer makes it possible for us to offer SILVERTONE Phonographs at a price which is much lower than those of any other instrument of the same high quality.

We believe that when you see the SILVERTONE and hear it play, you will be convinced of the truth of our claim for it. That is why we are making this liberal trial offer. We want you to try a SILVERTONE in your home for two weeks without the payment of one cent, and without obligating you in any way. Here is the offer:

No Money Down—Two Weeks' Trial

Select any SILVERTONE Phonograph shown on this page. Fill in the order blank at the bottom of this page, and mail it to Sears, Roebuck and Co., Chicago, Ill. **Send no money with it!** We ship SILVERTONE Phonographs on two weeks' trial. This trial is not just you one cent, we obligate you in any way. All we ask you to do is to give the phonograph a thorough trial. Examine its mechanical features, call out work and finish. Try it with any records you desire and note its beauty of tone, how faithfully and accurately it reproduces every delicate shading of tone quality, every minute variation of volume, every sound vibration. Give it every test necessary to prove the truth of our claim for it. And then compare the price of the SILVER-

STONE with that of any other phonograph of the same size, quality and musical excellence. If at the end of this two weeks' trial you are not fully satisfied with the phonograph, if you do not believe that mechanics, craftsmanship and workmanship, material and finish are the equal of any other phonograph on the market, we will return it to you at our own expense, and will return any transportation or cartage charges you have paid.

Small Monthly Payments

If at the end of two weeks you are fully satisfied with the SILVERTONE and desire to

keep it, send us the price of the phonograph you have selected in equal monthly payments until the total is paid. The amount of the monthly payment is shown under the illustrations of the various models. There is no interest or extra of any kind to pay.

Fill out the order blank today before this paper gets out of your hands, and let us send you one of these beautiful 1930 SILVERTONE models for two weeks' trial in your home without having to pay a cent down on the phonograph, and without obligating you in any way. You are to be the sole judge of the quality and value of the SILVERTONE.

Sears, Roebuck and Co.

The Reproducer.

Tone quality is dependent upon the reproducer, tone arm and amplifying chamber. Each must be designed and harmonized in the relation to the other two in order to produce a sweet, pleasing tone. The SILVERTONE reproducer restores every audio vibration, brought on, that all overtones and mechanical noises are reduced to the minimum.

Plays All Disc Records.

The SILVERTONE conserving tone arm permits the playing of any make of disc record. A universal joint in the tone arm makes it possible to adjust the reproducer as well as that it will play either vertical or lateral records. It is almost as easy to adjust the reproducer for different sizes of records as it is to change needles.

Amplifying Chamber.

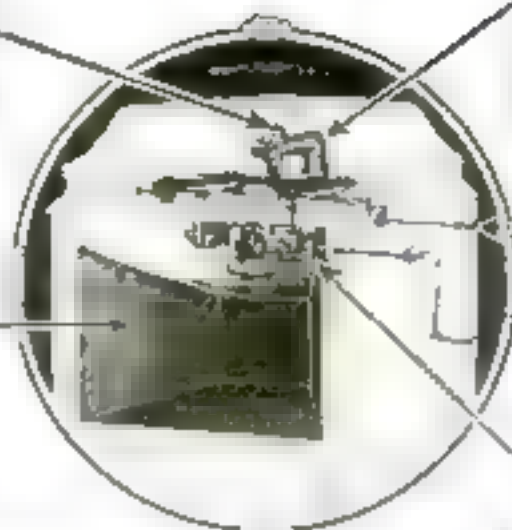
The sounds carried from the reproducer through the tone arm are given volume and resonance in a scientifically designed amplifying chamber or horn. This chamber is built of carefully seasoned wood and, like the sounding boards of a fine piano, imparts to the recorded sound vibrations sweetening and resonance.

Tone Control.

The tone distributor with which each SILVERTONE is equipped gives the tone control over the entire range of sound. You may see the distributor at any of the above points. This gives a uniform volume of sound of any character may be maintained while a record is being played. Thus enabling you to impart your own interpretation to the music.

Powerful, Silent Motor.

Every part of the SILVERTONE motor is made and fitted with care and precision, and gives much quieter operation. Springs furnish an independent of power and a perfectly designed, precision large the variable speed distributor system. The motor is equipped with a silent running device and gears with very little noise.



**Heppelwhite
Period Design**
Mahogany Fumed
or Golden Oak

Model IX Price, \$100.00

Dimensions over all 14 1/2 inches high, 14 1/2 inches wide and 12 in. deep. Net weight, ready to play 14 1/2 pounds. All visible metal parts are heavily nickel plated and polished. An assortment of needles included.

\$4.50
A Month



**Adam Period
Design.**
Fumed Oak

Model VIII Price, \$80.00

Dimensions over all 14 1/2 inches high, 14 1/2 inches wide and 12 in. deep. Net weight, ready to play 14 1/2 pounds. All visible metal parts are heavily nickel plated and polished. An assortment of needles included.

\$4.00
A Month

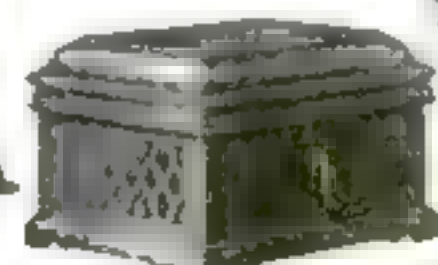


**Queen Anne
Period Design.**
Mahogany

Model VII Price, \$57.00

Dimensions over all 14 1/2 inches high, 14 1/2 inches wide and 12 in. deep. Net weight, ready to play 14 1/2 pounds. All visible metal parts are heavily nickel plated and polished. An assortment of needles included.

\$3.50
A Month



Golden Oak.

Model VI Price, \$48.00

Dimensions over all 14 1/2 inches high, 14 1/2 inches wide and 12 in. deep. Net weight, ready to play 14 1/2 pounds. All visible metal parts are heavily nickel plated and polished. An assortment of needles included.

\$3.00
A Month

USE THIS ORDER BLANK—CLIP ALONG DOTTED LINES.

Order Blank

SHIP BY Freight ☐ Express ☐

Name, Bookch and Co., Chicago Date 1920

You may ship me the SILVERTONE Phonograph which I have started with on (X) for the trial.

If, after two weeks' trial, I decide to keep and use the instrument, I will send you the first payment for the phonograph and pay the balance amount each month, or it paid in full then the SILVERTONE becomes my property. (Should I decide, after two weeks' trial, that the SILVERTONE is not satisfactory, I will notify you, and you are to give me the full refund of the cash I may send it back at your expense. You are also to return to me any transportation and storage charges I have paid.

I have always been faithful in paying my obligations and am making this statement for the purpose of informing you to credit me three times, and I give you my pledge that you may feel safe in trusting me to pay as agreed.

My Name

Sign your name here plainly and carefully. If under age, some member of your family who is of age and responsible should sign this order with you.

R. F. D. No. Box No.

Street and No.

Particulars

Shipping Point

I have been located in State

this birth place If less than 2 years, give former address

My business occupation

My profession is

Please give name of head of household in present address and specify the location of our records.

Name of head of household

(Please give names of TWO references) REFERENCES

Name

Address

Business or occupation

☐ Model VI Golden Oak, Price, \$48.00 \$2.00 a Month

☐ Model VII Mahogany, Price, \$57.00 \$3.50 a Month

☐ Model VIII Fumed Oak, Price, \$80.00 \$4.00 a Month

☐ Model IX Mahogany, Price, \$100.00 \$4.50 a Month

☐ Model IX Golden Oak, Price, \$100.00 \$4.50 a Month

☐ Model IX Fumed Oak, Price, \$100.00 \$4.50 a Month

☐ Model XI Mahogany, Price, \$145.00 \$8.00 a Month

☐ Model XI Walnut, Price, \$145.00 \$8.00 a Month

☐ Model XI Fumed Oak, Price, \$145.00 \$8.00 a Month

☐ Model XV Mahogany, Price, \$175.00 \$9.50 a Month

☐ Model XV Walnut, Price, \$175.00 \$9.50 a Month

☐ Model XVI Mahogany, Price, \$195.00 \$10.00 a Month

☐ Model XVI Walnut, Price, \$195.00 \$10.00 a Month

Period Design Cabinets.

SILVERTONE Cabinets are the finest product of the skilled cabinetmakers' art. Made in the most popular period designs, every one is a handsome piece of furniture—dignified, graceful and artistic in appearance. Only the finest selected woods are used in their construction and they are finished and fitted with that exquisite care and perfection which mark the work of the painstaking artisan.

Chicago

Dayton Bicycles



The Thrill of a Lifetime

GO where the water sparkles
in sunshine and...

...and where the water sparkles
in sunshine and...

...and where the water sparkles
in sunshine and...

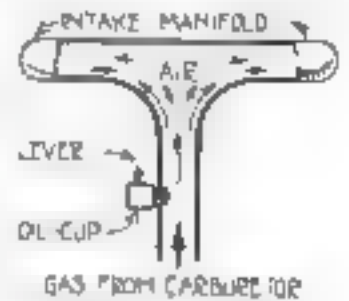
...and where the water sparkles
in sunshine and...

Cycle Dept., THE DAVIS SEWING MACHINE CO., Dayton, Ohio

"Ride a Bicycle"

Allow Your Automobile Engine to Breathe

CHANGES in temperature affect the carburetor to such an extent that in many cases adjustments must be modified to meet atmospheric conditions. An air-valve attached to the intake manifold will eliminate much of this trouble, for then the air adjustment can be changed by the simple turning of a lever.

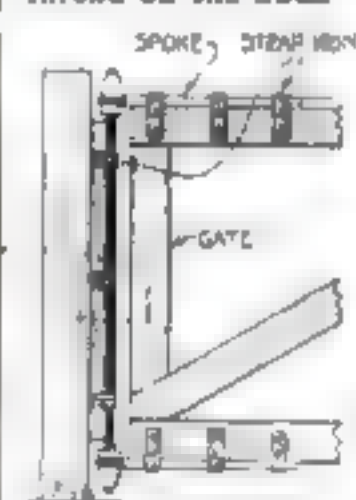


The most simple, yet effective, auxiliary air-valve is that made by threading a Ford oil-cup into a hole in the side of the intake manifold. A metal strip $\frac{1}{2}$ in. wide is soldered to one side of the movable part of the oil-cup, which will then form a lever to control the opening and closing of the valve. A hole is drilled near the end of this lever and a length of wire attached. This wire runs through copper tubing to the steering wheel, where it is manipulated at the will of the car driver. — R. L. PRINDLE.

Buggy-Axles and Wheel-Hubs Make Good Gate-Hinges

THE next time you have a spare buggy-axle and a gate that needs new hinges, make them work together in the cause of economy.

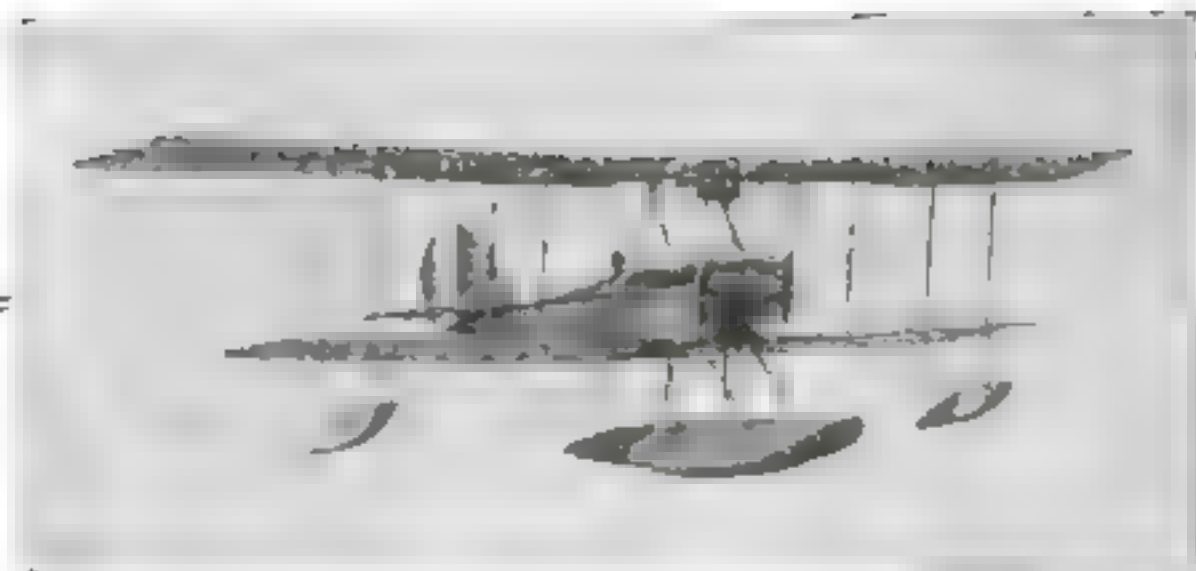
Clamp the axle to the gate-post, as shown in the illustration, so that the bottom end of the axle will come 3 or 4 in. from the ground. Put the hubs of the wheels on the axles, and thread on the nuts. Leave one spoke



in each hub, and use it to clamp to the bottom and top boards of the gate. Three or four little U-shaped clamps, looped over the spoke and screwed to the gate, will hold it firmly.

The axle will have to be fastened to a piece of wood, and the wood secured to the gate-post, if the post is longer than the axle.

This is a good solid way of suspending a gate, and the axle will outwear several pairs of ordinary hinges, provided it is greased and painted to withstand the elements. The axle-hinge has also the virtue of being easily adjusted. — THORNTON HALLETT



NAVY SALE OF SEAPLANES

A large quantity of seaplanes, spare parts and accessories are offered for sale by the NAVY at fixed prices. This is an unusual opportunity and should be given careful consideration by everyone who is interested in aviation.

PLANES ARE NEW - NEVER HAVE BEEN FLOWN

and most of them are still crated as received from the makers. They have been well taken care of and are in excellent condition. We advise immediate action, as orders will be accepted and filled in the order in which deposits are received. The following are offered:

H-24 TYPE FLYING BOATS—pusher biplane—one Liberty engine of 300 H. P.—wing spread (Upper plane) 74 ft.—total supporting surface 403 sq. ft.—maximum speed 85 miles per hr.—Sale price \$6,000

H-16 TYPE FLYING BOATS—tractor biplane—two Liberty engines of 350 H. P.—each—wing spread 95 ft.—total wing surface 1,564 sq. ft.—maximum speed 95 miles per hr.—Sale price \$11,053

F-5L TYPE FLYING BOATS—essentially same as H-16 (lot 2) but larger—wing spreads 104 ft.—total area 1,997 sq. ft.—maximum speed of 97 miles per hr.—Sale price \$12,400

AERONARINE TYPE 39-H SEA PLANE (pictured above)—tractor biplane—Curtiss 100 H. P. engine—wing spread 47 ft.—total area 494 sq. ft.—maximum speed 72 miles per hr.—Sale price \$3,000

This we consider our best buy. Endorsed by NAVY flyers as the safest and most easily operated seaplane. A manufacturer is marketing a set of wheels and tail skid which substituted for the pontoon, converts this into a successful land plane.

MODEL 40 FLYING BOATS—pusher biplane—one Curtiss 100 H. P. engine—wing spread approx. 48 ft.—total area

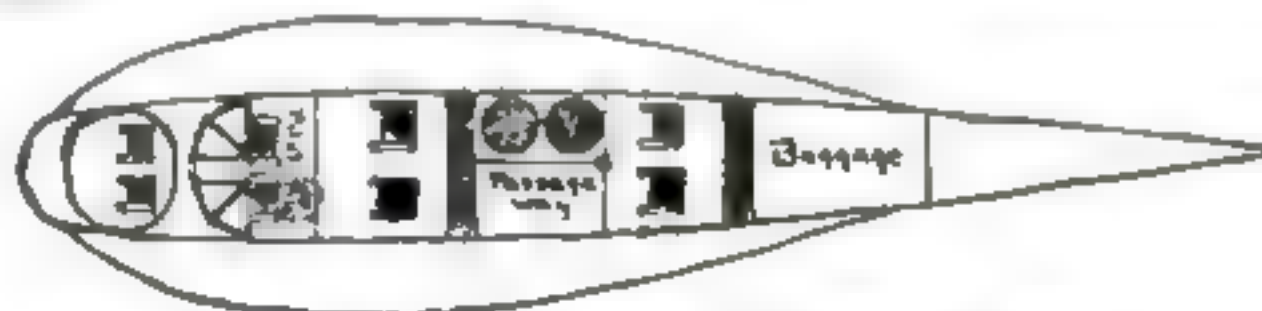
504 sq. ft.—maximum speed of 70 miles per hr.—Sale price \$4,000

CURTIS GNOME SPEED SCOUTS—complete with Curtiss engine installed. Never flown. Packed in original cases. Sale price \$2,000

HOFFING SEAPLANES—tractor biplane—one 112-Scott 100 H. P. engine—wing spread 44 ft.—total wing area 495 sq. ft.—maximum speed of 72 miles per hr.—Sale price \$2,000

TYPE "R" KITE BALLOONS—Used for observation and instruction purposes. Towed by vessels and also flown from land. Sale price \$2,500

Those who follow aerial affairs closely, no doubt noticed a recent newspaper item which told of a record breaking flight from Miami, Fla., to Havana, Cuba, in 14 hours by a seaplane carrying sixteen persons and baggage. The plane making this record was a type 1 flying boat, lot 2, purchased from the NAVY and was originally designed to carry four persons. The sketch shows how it was converted to carry SIXTEEN PERSONS AND BAGGAGE at a cost of about \$1,000 for the necessary alterations. You can do the same.



5% OF PURCHASE PRICE—BUYS A PLANE

Just send to the Bureau of Supplies and Accounts, Navy Department, 5% of the amount of your order with your order, and the goods are yours, subject of course to prior sale. This deposit can be by certified check or money order drawn to the order of the Paymaster General of the Navy, or the bond of a surety company acceptable as sureties on Federal Bonds. The balance shall be paid within 30 days after acceptance of your order.

ENGINES AND SPARE PARTS

In addition to the planes the NAVY is offering a number of sets of spare parts, at fixed prices, which can be purchased with or without a plane. ENGINES, new and used, are offered in an astonishing assortment and at prices equally astonishing. The list includes REMITT, HALL SCOTT, CURTIS V-2, INDIAVERASCHINI, STURTEVANT, CURTIS OX AND OXA, GNOME, FIAT and the LIBERTY. The prices range from 175 to 2000 dollars according to make and condition.

ORDER FROM THIS ANNOUNCEMENT AND AVOID DISAPPOINTMENT

Several lots included in the sale at the start are completely sold out, several times as many orders being received as there were planes for sale. Orders will be attended to in rotation as they come in, so we advise ordering from the descriptions given above. But for those who desire additional information the NAVY has prepared a beautiful illustrated catalogue which will be sent free on request to the

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The makers of U. S. Bicycle Tires have at stake the same U. S. Tire reputation that car owners and truck owners rely upon. All the resources, men and equipment of the United States Rubber Company, oldest

and largest in the world, stand back of your U. S. Bicycle Tire investment.

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If you want to know about the rubber that goes into U. S. Bicycle Tires, write for a copy of the graphically illustrated and fascinatingly written book, "Rubber—A Wonder Story." Address U. S. Rubber Company, Bicycle Tire Division, New York.

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*This is the sign that identifies
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Daylo 10,000 Contest
Picture. Look for this
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Three Thousand Dollars For Somebody. YOU?

THREE thousand dollars in cash for one person; a thousand dollars for another; five hundred for each of three other people and ninety-nine other cash prizes from two hundred to ten dollars. *Ten thousand dollars in all!* How much for YOU?

This latest Eveready Daylo Contest will break all contest records. Anyone may enter—it costs nothing; there is no obligation of any kind. Men, women, boys and girls all have equal chances for any of the 104 cash prizes.

On June 1st, Daylo dealers throughout the United States and Canada will display the new Daylo Contest Picture in their windows. Go to the store of a Daylo dealer and study the picture. Secure a contest blank, which the dealer will give you, and write on it what you think the letter says. Use 12 words or less. For the best answer that conforms to the contest rules, the winner will receive \$3,000.00 in cash.

Get an early look at the picture. Submit as many answers as you wish. Contest blanks are free at all Daylo dealers. All answers must be mailed before midnight, August 1st, 1920.

A-1314



1	First Prize	\$3,000	1st
1	Second Prize	1,000	2nd
2	Prize	500	3rd
4	Prize	250	4th
5	Prize	125	5th
10	Prize	62.50	6th
10	Prize	31.25	7th
20	Prize	15.62	8th
20	Prize	7.81	9th
40	Prize	3.90	10th

Total 148,892.00

Answers will be judged by the editors of "LIFE" and contestants must abide by their judgment.

If two or more contestants submit the identical answer selected by the judges for any prize, the full amount of the prize will be paid to each.

Contest begins June 1, 1920, and ends midnight, August 1, 1920. Postmarks on letters will determine if letter was mailed before close of contest.

Answers must contain not more than 12 words. Hyphenated words count as one word.

Complete Contest Rules are printed on Contest Blank. Ask Dayco dealers for them.



Metal Workers

This Means Money to You

[illegible]

In the third version the source of inspiration is thoroughly rational, for while the category of "realistic forms" will be found more often in a circle of three or four, it is grouped in the other two classes, "fantasy" or "dream forms," combined in the same way with the placing of "beast forms" in "fantasy" and "man forms" in "dream forms." This is a completely different way of classifying the material, and it is assumed to show why different people have different tastes in art.

The fourth section gives the reader the benefit of the short-cut methods developed by experts during the past few years.

5-4819 This new volume, with its new problems on the development of such modern works as automobile bodies & ships, features much less air-sea navigation, graph reduced, dust separations, colorations, & less work. Features features designed for the body, more complete & complete range of materials, bodies, sprays, etc. as well as the price of the book to those who have the former editions.

POPULAR SCIENCE MONTHLY
221 West 39th Street, New York City

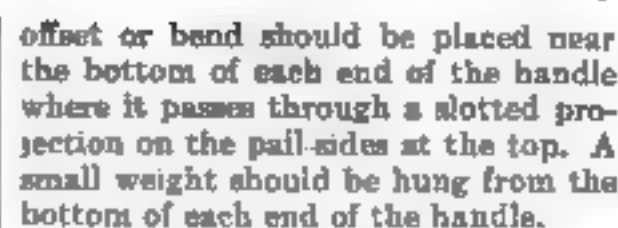
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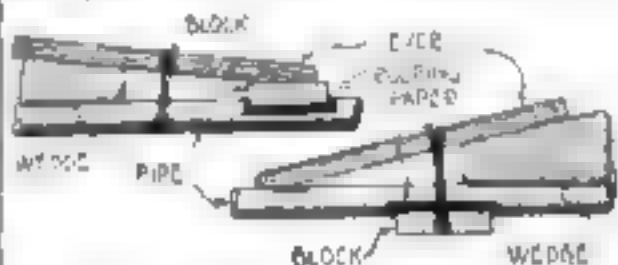
As shown in the illustration, both weights form an integral part of the handle and cause it to move automatically to its vertical position.

Before the Flood: First Aid for the Leaky Water-Pipe

THE illustration shows a way in which a temporary repair can be made for a small leak in a water-pipe.

The method depends greatly upon the position of the rupture and its accessibility.

Provide yourself with a wooden wedge and a lever of stout wood

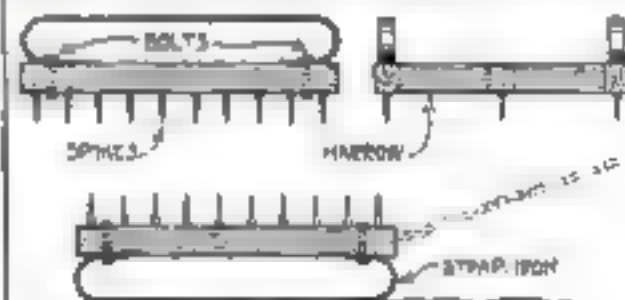


Why wait for the plumber when you have a leaky water-pipe? Make your own repair with wooden blocks.

about 2 ft. long. Cover the leak with a strip of roofing-paper, placing cement or tar between it and the pipe. Then over the roofing-paper set a block of wood, with a curve in one face to fit the curve of the pipe. Now, place the lever on the pipe, and strap it down against a second blocking, as shown. This will keep the opposite end of the lever several inches away from the pipe. Driving the wedge between the lever and the pipe applies great pressure to the other end of the lever, and the patch is thus forced over the leak.

Make Runners for the Top of Your Harrow

WHEN the rigid type of spike-tooth harrow is being moved from barn to field, or from one field to another, a wagon or stone boat is usually employed. The accompanying illustration shows such a harrow



If you will attach runners to the top of your harrow, you need only reverse it to haul it away.

equipped with strap-iron runners which eliminate the necessity for having a separate vehicle to move it.

The runners are simple to make and easy to attach. Two- or three-in. strap-iron, bent to the shape shown and bolted to the harrow frame, serves the purpose.

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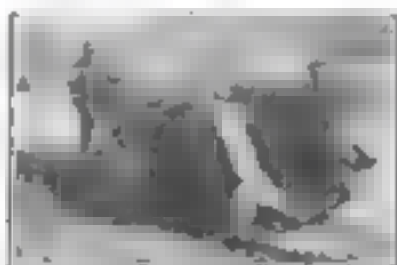
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Growing Potatoes in a Pen Saves Garden Space

GROWING Irish potatoes in a pen is the city dweller's latest device for increasing his food supply. W. E. Ashley, of Greensboro, N. C., has devised a method capable of producing forty bushels of "spuds" in the "jamb of a fence" within two months.

The invention somewhat resembles a pig-pen. Two hundred feet of 2 by 4 scantling, 4 bundles of wheat-straw, 100 lbs. of fertilizer, and 4 tons of soil are the necessary materials.

The arrangement determines the success or failure of the practical potato-pen. The end-pieces of both edges are gained, except the two



In these high-cost-of-living days, back yard soil is at a premium. Growing potatoes in a pen sounds funny, but here's the way to do it and get results

bottom hills. These are shaved on one side only, the rough edges being placed on the ground. The margin of space between the inside edges of the gains is 6 ft.

The side-pieces are gained on one edge only, 8 ft. between the insides of the gains; all gains are $\frac{1}{4}$ in. deep. Care should be exercised not to bes them too deep, as there should be at least 3 in. between the scantling on both the sides and the ends of the pen.

On a level foundation are placed two end-pieces that are gained on one edge only. Two side-pieces are supplemented and filled in with 6 in. of soil; to which is added 15 lbs. of fertilizer. Then the first row of seed is started 6 in. from the inside of one end, placing the other seed in this row 1 ft. apart.

The second row is started from the same end and the first seed is put 12 in. from the inside. By planting the remainder of the seed in that row 12 in. apart, the hills are staggered like a checkerboard—45 seed in each bed. On this bed is scattered 6 in. of wheat-straw, which is wet down thoroughly.

Next, a set of scantlings is placed all around and filled in with 6 in. of soil. It is fertilized as was the first bed. The planting is started in the first row 12 in. from the same end as the initial layer so as to provide as much growing space as possible in the pen. Set in good soil, well fertilized and kept moist, the potatoes will mature in two months.

As to the labor required to put up a pen, a good worker can easily do it in a day and a half. The average business man could complete a pen in two days.



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MORE than anything—it is health, the heritage of nature. Strong men and women can smile at the trials of life, for they have the strength and stamina to weather reverses and win to success.

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An Easily Made Vise Attachment

By R. H. Casper

IN the accompanying illustrations is shown an attachment whereby a number of pieces of varying thickness may be held in a vise simultaneously and each with the same pressure. This is a decided time-saver, especially on planer or shaper work when a number of pieces are to be planed to the same height. A pressure on any

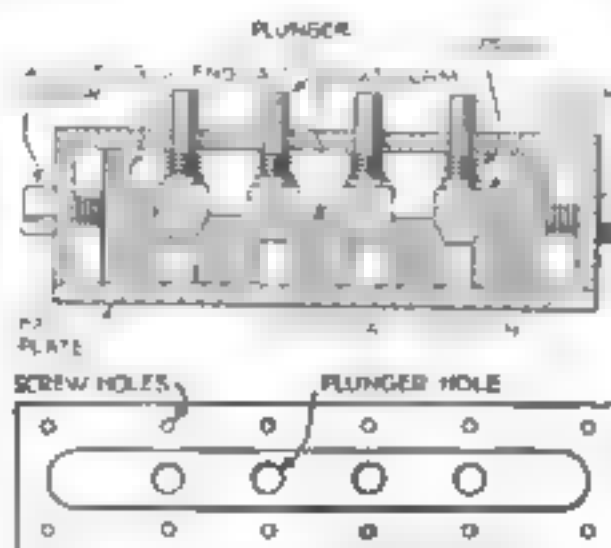


FIG. 1 BACK VIEW OF OUTSIDE OF CASE WITH BACK PLATE REMOVED

By turning the adjusting-screws in or out, you can adapt the plungers to practically any combination of surfaces

one plunger causes the other three to move out; a pressure on two plungers causes the other two to move out; and so on. As each plunger depends upon its neighbor for its pressure, it is evident that the pressure on all will be equal.

The back plate is held on by countersunk screws which are not shown in the illustration.

In order to increase the capacity of the attachment, adjusting-screws are placed on each end. By turning these screws in or out, as needed, the plungers will adapt themselves to practically any combination of surfaces within the capacity of the attachment. (Fig. 1.)

In Fig. 2, which shows the attachment in operation, the adjusting-screws have been somewhat withdrawn. The springs return the plungers to the neutral position as soon as the pressure is released. The details of the internal mechanism also are shown in this figure.

If the ends of the plungers are fitted with ball-jointed feet, curved surfaces, or surfaces not parallel with the vise jaws, may readily be held.

The construction of such an attachment is not as difficult as it may at first appear. The outside case shown in the illustration was made from a block of cast-iron. It was first drilled at each end with a drill equal in diameter to the thickness of the cams. The holes thus made were given a depth equal to the height of the end cam. The metal between the two holes was then removed with an end-mill on a milling-machine.

The home worker, not having a milling-machine at his disposal, must proceed in a slightly different manner. Instead of only two holes, it is necessary for him to drill a series of holes, all on the center-line of the block, and so spaced that each hole will break into the adjoining one. These holes must be drilled all the way through the block. The metal which is left between the drill holes is then chipped out, and the slot, thus produced, is smoothed with a file. This method necessitates fastening a plate to the front of the attachment. The plate is the same as the back plate, except that it is drilled for the plungers. Since all the pressure is against the back plate, which is supported by the vise-jaw when in operation, there is no danger of the front plates being forced off.

The sliding cams are made by cutting rectangular pieces of steel, of the required thickness, and filing off their corners to the required angle. An angle of 120° as shown in Fig. 2, will give the best results. If the four upper cam, or the three lower cam, are clamped together in the vise while being filed, they will all be brought to the same dimensions.

The end cams are made in the same manner, except that the ends are rounded. This rounding permits them to be withdrawn to the extreme ends of the slot.

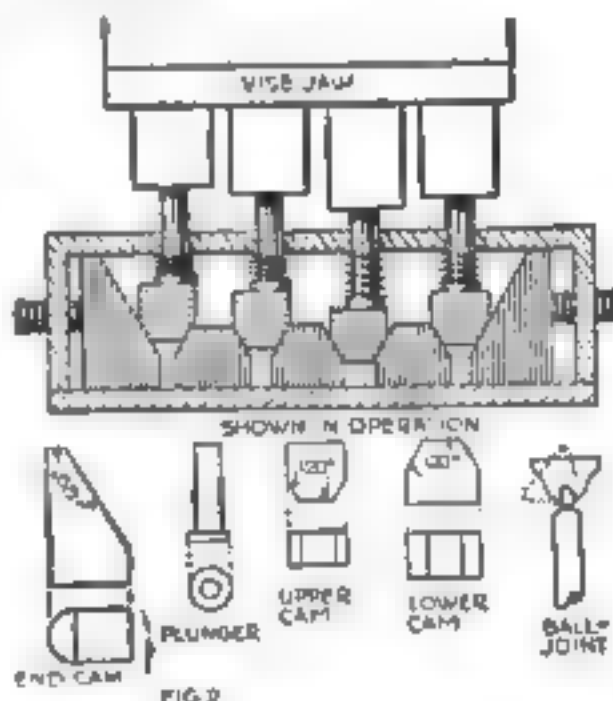


FIG. 2 Here are shown the details of the internal mechanism. The construction of this apparatus is not difficult or costly

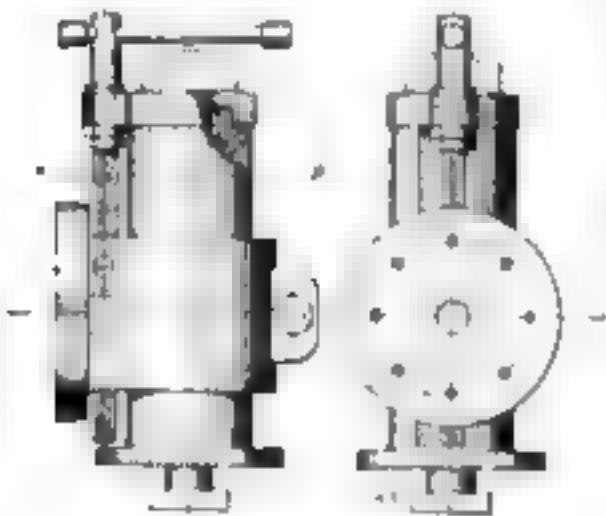
If a lathe is at hand, the plungers may be made by turning two of them from one bar and then cutting them apart. As the shape of the plunger head is immaterial, ordinary hexagon-head cap-screws may be used for plungers by reducing the heads and filing them flat on top.

A generous supply of thick grease should be inserted into the case before attaching the back plate, with all parts well oiled.

How to Make a Lathe-Milling Attachment

THERE are many milling attachments for small lathes, but most of them require sliding ways which must be milled or planed and require accurate fitting, often beyond the capabilities of the amateur equipped only with a small screw-cutting lathe. Here is a milling attachment of very simple construction to be used where the work must all be performed on the lathe and bench.

It is to be bolted to the tool slide of the lathe, and the work to be milled is attached to it, the cutters being rotated in the lathe-chuck or other holder. Longitudinal and transverse feed is given the work by the tool slide, while the vertical adjustment is made by a slide that moves up and down on a vertical column, this being cylindrical, instead of having V- or



The slide carries an adjusting screw as shown in Fig. 1. Fig. 2 is a front view.

flat slides, in order to allow of its construction on the lathe.

The face of the slide is circular, turned off smoothly, and mounted on an angle-plate on the lathe-face plate. A $\frac{3}{4}$ -in. hole is drilled and tapped in the center, in order to hold an angle-plate (as shown in Fig. 6) or to take a lathe-chuck adaptor (made as in Fig. 5). Ordinary work, such as plates or shafting, is best held by one clamp or a pair of small clamps (Fig. 7). A clamp is made in two sizes, and is provided with a counter-sunk hole in the base to hold a machine-screw for holding it down. A series of holes may be drilled and tapped around the surface of the milling fixture slide, to hold the clamps in any desired position; a pair of them will hold a shaft or bar very firmly. Cylindrical work is held in a lathe-chuck screwed to the adaptor (Fig. 5), while some work is best held by an angle-plate, which can be bought and drilled for the bolt, cast from a pattern and file-finished, or even built up of two steel plates.

The upright is a steel or cast-iron column cored out or drilled for a long bolt to clamp it to the tool slide. A cast-iron cap fits over the top, and is held in place by a short key and the nut on top. It is provided with a



*Teach Them
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HIRES is good for all ages—at all times. Every one of the sixteen Hires ingredients is a product of Nature from the woods and fields, collected from all parts of the world.

Nothing goes into Hires but the pure healthful juices of roots, barks, herbs, berries — and pure cane sugar. The quality of Hires is maintained in spite of tremendously increased cost of ingredients. Yet you pay no more for Hires the genuine than you do for an artificial imitation.

But be sure you say "Hires" to get Hires. At fountains, or in bottles, at your dealers. Keep a case at home and always have Hires on ice as first aid to parched palates.

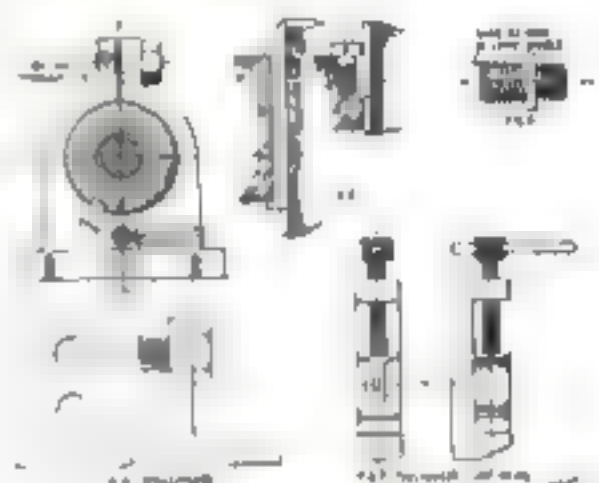
THE CHARLES E. HIRES COMPANY, PHILADELPHIA

Hires

Hires contains juices of 16 roots, barks, herbs and berries

boss for the adjusting screw and handle. The long keyway may be made by first drilling a series of shallow holes and then setting the column between lathe centers, and with the lathe tool over on its side in the tool-post, shaping the keyway by running the tool-post back and forth by hand. Fig. 4 shows two methods of fitting the key in the slide. The best way is to use a long hooked key, but this necessitates filing and chipping a keyway the whole length of the slide. An easier way would be to chip a short keyway, fit a key of the same length, and hold this in place by a machine-screw, as shown.

After boring out, the slide is slit with a hacksaw and the clamping bolt fitted. The adjusting screw may be tapped directly into the slide casting, but it would be better to bore a hole larger than the screw, drive in a bronze or gun-metal bushing, tap this to fit the screw, and hold it in place by



Figs. 3, 4, 5, 6, and 7 show how the parts will appear when finished. No part of the work is difficult.

means of a set-screw, as in Figs. 1 and 3. Any kind of a handle can be used on the end of the adjusting screw; the type shown in Fig. 1 is easily made and not in the way.—H. H. PARKER.

You Can't Have Eggs and Mites at the Same Time

POULTRY men and farmers sometimes overlook a very important fact; that even the best of feed, plentiful and well-balanced, will not induce hens to lay eggs if they are compelled to roost in houses infested with mites.

These little red insects sap the vitality of the hen by sucking her blood. Hens have been killed, virtually eaten alive, by mites. Chickens cannot lay except when their vitality is maintained. Vitality and mites cannot exist in the same hen-roost.

At the first sign of warm weather guard against mites by giving all wood-work inside the poultry-house a coat of hot whitewash, well carbolized.

The roosts and their supports should be painted all over with carbolineum, zeno-eum, carboline, or kresol. These are all similar products, called by different names by different manufacturers. They are creso- or tar-oil disinfectants, and are death to mites, while in no way injurious to the chickens.



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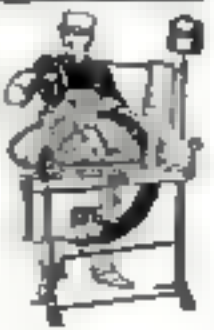
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Make a Support for Spark-Plug Wires

ON some cars the wires or cables leading from the distributor to the spark-plugs are left dangling loosely, so that they come in contact with the engine and other parts and become chafed until a short-circuit or ground occurs. Besides, they drag on the plug clips and look decidedly untidy.

Make a support or bracket for these cables from a piece of hard fiber not less than 18 in. thick, with holes for the cables just large enough for the cables to fit tightly and without slipping. Round off the edges of the holes to avoid cutting. If the wires are long and heavy, make the holes a little larger, and wind a couple of turns of tape around each wire where it passes through. Rivet the fiber to



The diagram shows a cross-section of a metal support. It is a rectangular block with a central horizontal slot. Inside this slot, there are four circular holes, each containing a cable. The cables are labeled 'CABLE' with lines pointing to them. The metal support is labeled 'METAL SUPPORT' with a line pointing to the bottom edge. The top edge of the support is labeled 'RIVET' with a line pointing to a small circular feature. The right side of the support is labeled 'END' with a line pointing to the right edge.

Oil-soaked wires are bound to short-circuit. Why not prevent them from getting into the ground, in this manner?



Oil-soaked wires are bound to short-circuit. Why not prevent them from getting into the system in this manner?

an L-shaped bracket of sheet-iron or brass, and drill a hole for a cylinder-head screw or any other screw or bolt that is in a convenient place for the purpose.

This arrangement makes a surprising difference in the life of the cables, as well as in the appearance of the power plant.

An Alligator Wrench You Can Make at Home

THE accompanying illustration shows an alligator wrench that is much more efficient than the regular type. The advantage lies in having



This new style home-made alligator wrench affords a tight grip on the bolt or pipe, and does not mutilate the metal.

tighter, instead of mutilating the corners of the nut and then slipping off, as the old-style wrench does.

The average mechanic will not find this wrench hard to make. The one illustrated was made from pieces of spring-steel about $\frac{3}{4}$ in. in diameter, and from 12 to 15 in. long, flattened out until about $\frac{1}{4}$ in. thick. The notches can be made best by first cutting them the desired depth (about $\frac{1}{4}$ in.) with a back-saw, and then finishing them with a three-cornered file. This notched part is then bent around to the proper shape, and the wrench tempered, in oil.—M. L. DODSON.

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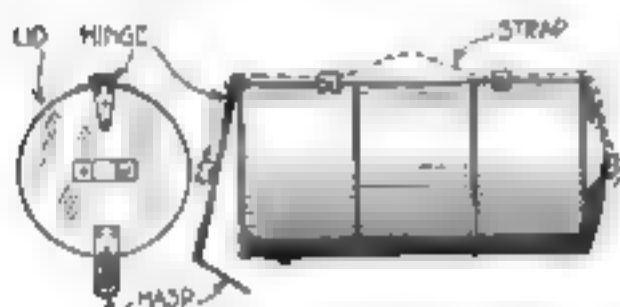
steel rod between the wood block and the piston.

With air pressure at 100 lbs. it was easy to secure a pressure of 600 and 800 lbs. on the punch, which, with the cutting edges in any respectable shape, was more than sufficient to cut through old tire casings and leather, and, in the case of the smaller solid punches, actually to cut through sheet iron and steel. For this smaller work, however, it was found advisable to provide the bed-block with a sheet of iron, with holes to correspond with the sizes of punches used, and to act as the stationary cutting edge.—DALE R. VAN HORN

A Metal Holder Used as a Tool-Box

A CERTAIN mechanic uses a tool-box of his own construction which has considerable merit.

The box is very much like a butterfly-hunter's specimen-box, but is built



Though it looks like a specimen-box, it is really a mechanic's tool-carrying outfit.

to stand rough usage. Heavy sheet metal is used in the construction. Four projecting ribs, two at the ends and two in the center, act as a reinforcement. The lid swings on a hinge, and is provided with a hasp for locking purposes. A leather strap, running through guides at each end, forms the handle.—J. M. KANE

Keep the Distributor Clean and Dry

EXCESSIVE oiling of the magneto can do nearly as much harm as insufficient lubrication. One thing it does is to cause the surplus oil to be thrown into the distributor, where it works much mischief. It gets between the brush and the contacts and either insulates them from each other entirely, causing missing, or it causes arching. Arching burns the oil and forms soot, which interferes with the good working of the machine, and it also produces heat, which disintegrates the carbon brush and causes it to crumble.

All magneto manufacturers make their distributors so that they may be removed easily and wiped clean with a dry, clean cloth. One type of machine, for instance, has its distributor held on by three little clips, retained by three thumb nuts. These may be loosened by hand, the clips turned aside and the distributor cover comes off in the hand. Other magnetos have three screws to



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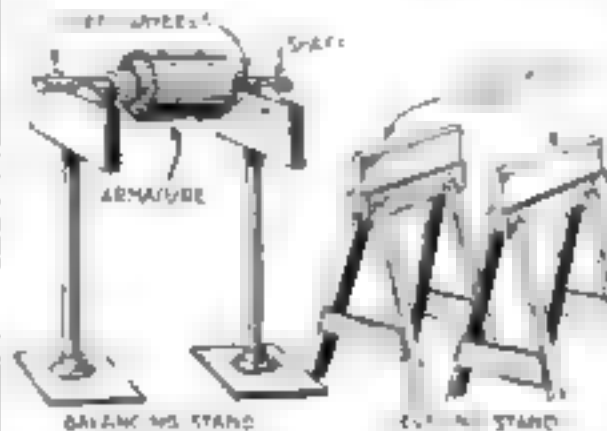
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retain the cover. Some have a central revolving brush and stationary contacts in the cover and others a revolving contact and individual stationary brushes in the cover. The brushes in either case are attached to small springs which may be slipped in or out.

Balance Your Armatures and Eliminate Noise

If the armature of a motor is not balanced, it probably will cause noise when running at normal speed. In order to insure balance, the arma-



An unbalanced armature in a motor makes it noisy. A stand will enable it to balance

ture must be removed from the machine and placed on a balancing-stand or on level knife-edge bars to ascertain which is the heavy side. The accompanying illustration shows the procedure.

If the armature is balanced properly, it will show no uniformity in the power at which it stops after being rotated by hand; but if it is not in balance, it will invariably stop in the same position on the balancing rig, with the heavy side downward. A counterbalancing weight should then be hung on the light side, and thereupon, after slight filing, a very accurate balance will result. Before attempting to make a permanent correction ascertain by trial just how much weight should be added or removed.—PETER CLUTE.

Utilizing the Hollow Handles of a Die-Stock

In threading pipe some form of lubricant is necessary to avoid ruining the dies, and it is the usual practice to carry along an oil-can, either in the tool-box or tied to the die-stocks.

Often when out on the job, one will find that the oil-can has been forgotten or perhaps lost. In this case the mechanic will have either to cut the threads dry, or damage the dies, or else to put up with the delay of obtaining the lubricant at a nearby store. Very often, indeed, this happens when the job is "ten miles from nowhere," and nothing in the way of grease or oil is obtainable. Under such circumstances it would be very convenient merely to unscrew one of the handles from the die-stock, and slip out a container filled with cup-grease or oil. This suggestion of utilizing the hollow

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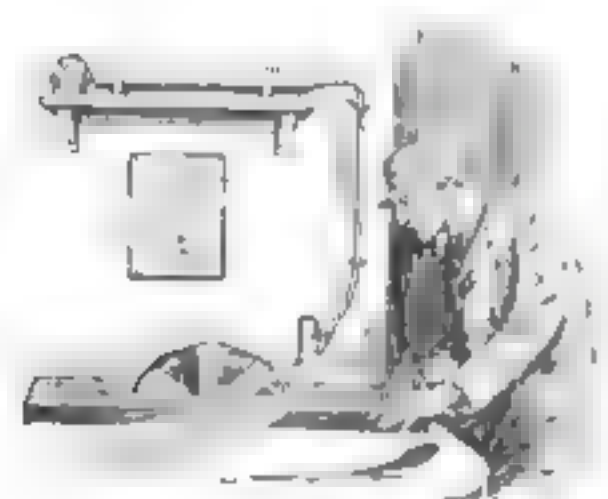
handles of the stocks to carry an emergency ration of lubricant in a tubular container will be found very practical.

The outer ends of the handles can be plugged up with a piece of soft wood. This should be driven from the threaded end through the length of handle, and pressed tightly against the turned-in edges of the outer end, which will prevent the plug from slipping out, even if it shrinks. The hollow handles also provide a ready means of carrying such articles as spare hack-saw blades, candle, matches, etc., which, when wanted, are badly wanted. —J. A. WEAVER.

Use a Simple Air-Blast for Your Power-Saw

THE illustration shows a device used by one carpenter in his shop to keep his work free from shavings and sawdust. A small motor drives a fan inserted in one end of a 4-in. galvanized iron tube, which tapers to a spout and is connected to a 3/4-in. rubber air-line, the other end of which is secured at the point above the bench most effective for directing the air-stream on to the work.

A 2 by 8-in. piece was cut 8 ft. long, and the motor, 1/2 h. p., was mounted to one end. The tube, which contains the fan and acts as a cushion by con-

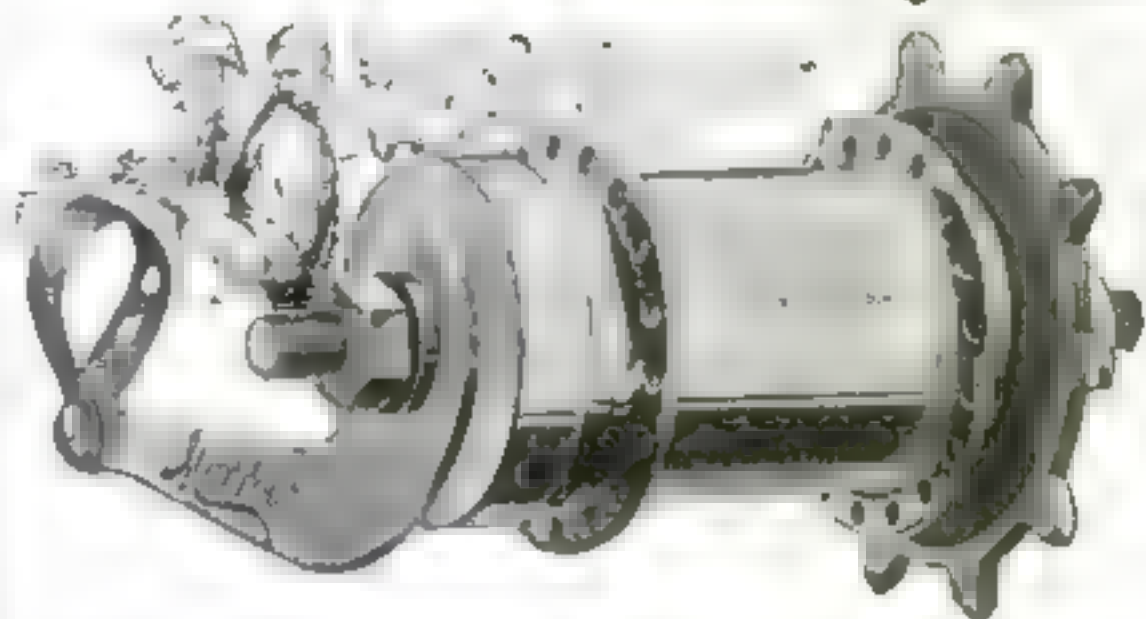


An air-blast on your power-saw will keep the sawdust and shavings away from your work and, incidentally, away from your eyes too

taining its length of air under slight pressure, was made of galvanized iron, 4 in. in diameter. Strap-irons hold the tube to the 2-in. support at a point where the 4-in. fan on the motor fitted within the tube without binding. The tube was 30 in. long.

To the other end of the tube, a small tin funnel was soldered, and the length of air-line was then slipped over the end and brought to the point of use. The outlet end of the air-line can be arranged to the best advantage. If it is to be used with a power-saw, it can be so wired that it will keep the pencil line free from dust. The air-pressure produced by the electric motor will be no more than 3/4 lb., but it will be sufficient, and the expense is practically nothing. —DALE VAN HORN.

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An Improvement on the Artist's Pantograph

By James M. Kane

THE inconvenient construction of an ordinary wooden pantograph led the writer to remodel it as displayed in the illustrations.

The marking point and stylus were screwed to the under side of arms B and D. Being hard to shift for reducing a drawing, they were removed and fitted upon pencil-holding devices

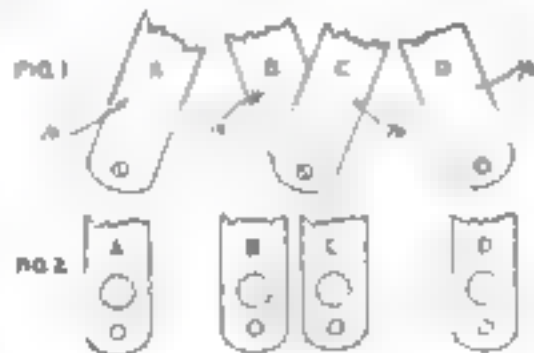


Fig. 1 shows the ends of the arms as they were originally. Fig. 2 shows the new series of holes in them.

which made the pencil and stylus quickly interchangeable and adjustable for height as well.

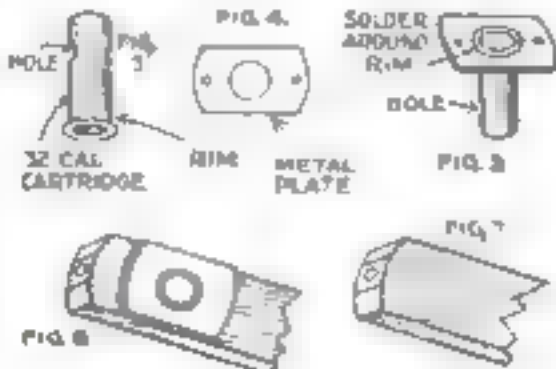
Two .32-caliber cartridge shells (long), two inches of the brass frame of an old alarm-clock works, an old gas-globe holder, four small screws, and two $\frac{1}{4}$ in. pieces of tubing to slip over the cartridges were all the materials required.

Fig. 1 shows the ends of the arms as they were originally.

Fig. 2 shows the new series of holes in line. The small hole in A is a shifting of the hole upward, so that the fastening screw will line up centrally with the holes in B and D. These holes were carefully bored and trimmed so that the pencil-holding devices would fit correctly.

Fig. 3 shows how the end of each shell was bored out, leaving the rim intact; it also shows the hole in the side for the entrance of the point of the tightening screw.

Fig. 4 shows the metal plate, made from the section of the alarm-clock



Figs. 3 to 6 show how the holder was made and fitted into the hole in the pantograph's arm.

frame, soldered to each shell. This plate is bored for the insertion of screws.

Fig. 5 shows the plate soldered to the cartridge.

Fig. 6 illustrates the holder fitted into the hole in the pantograph arm and screwed fast.

Arms B and D are each fitted with one of these holders. The holder in arm B also acts as a pivot for arm C. In this it performs the function of the screw that originally held arms B and D.

To hold the pencil and stylus securely, as well as to permit adjustment for height, short metal collars fitted with tightening screws were slipped over each holder.

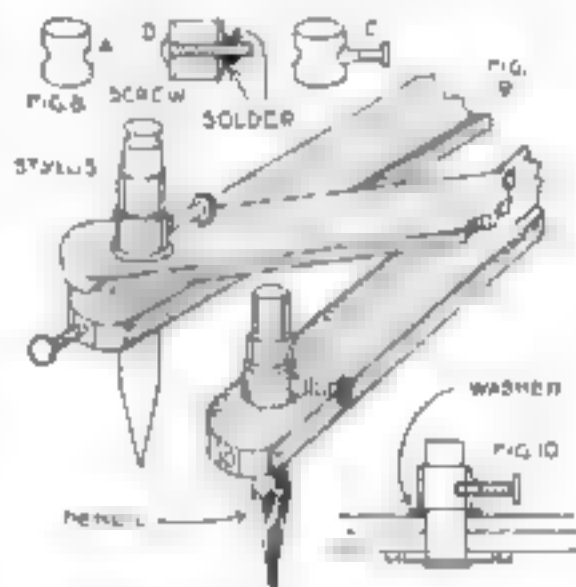
The old globe-holder furnished the screws and nuts, while the two $\frac{1}{2}$ in. sections of tubing provided the collars.

The only difficult part of the whole operation is soldering the small nuts on the collar. This is the way to do it.

First cut off the section of the globe-holder that holds the nuts and screws and file the nuts bright. Then bore a hole, in line, through each side of the collar (A, Fig. 8). Now run the screw through the collar and attach the nut securely to it (B, Fig. 8). After soldering the nut, remove the screw and replace it as in C, Fig. 8.

Fig. 9 shows in perspective the arms fitted with the improvement.

Fig. 10 is a cross-section of arms and



Figs. 8 to 10 show how the pencil and stylus may be interchanged.

holder. It also shows a thin washer that may be placed between the bottom of the collar and the upper surface of arm C.

Into the ends of arms B and D small nuts taken from globe-holders may be glued to serve as sockets for the reception of an extension handle.

Keep Your Eye on the Automobile Generator

THE brushes are a part of the generator that demand the most care. They should be examined to see that they are in perfect contact with the commutator, and that they do not stick in the brush-holders. One of the most usual causes of imperfect contact between the brush and the commutator is insufficient spring tension.

The commutator must be kept clean, as any dust or grease on the segments will collect carbon dust and produce short circuits.

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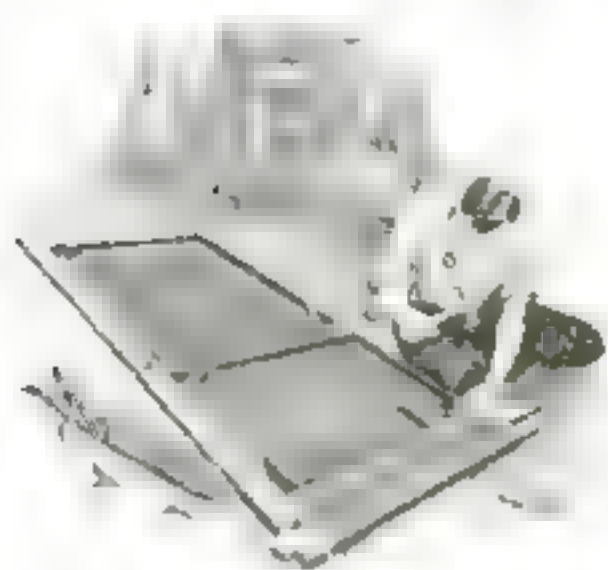
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An Easy Way to Put Wire-Cloth on Screen Doors

THE screen door, which contributes so much to the comfort of the human race, has one drawback, the rusting of the wire cloth. New material must be put on to replace the old, and this is a very disagreeable task. To do the job in double-quick time the writer has devised the simple plan illustrated, which proves to be much more efficient than the usual method of stretching wire-cloth on screen doors.

The old way of doing this work was to tack one side down first and then to pull the opposite one as tightly as



Here is the way to make a one-man job of putting wire-cloth on screen doors

possible with one hand; the other hand was used to stick a tack in the wood and hammer it down. Of course, if the workman has another member of the family do the tacking while he tightens the cloth, a much neater job can be done.

The new method requires the work of only one person, and it enables that one person to do a neater job than two could turn out under the old plan.

The illustration shows clearly the wedges and tightening pieces which are needed. They consist simply of a piece of wood the length of the door, with flat pieces nailed or screwed at right angles to the tightening-bar.

Lay the door flat on the floor and tack one edge of the wire cloth to the top of it. Then tack the other end of the cloth to the second section, adjusting the wedges in such a manner that they will have some space to drive in and stretch the cloth. Drive in the wedges until the cloth lies smooth, then tack it down, cutting off any surplus cloth with a pair of scissors. As the door is put over the right-angled pieces, the weight of it prevents the wedges from flying out when tension is exerted on the cloth. Do not have too much tension put on the cloth when it is fastened down, for when it begins to rust in one part, it will break under expansion and contraction. Since most people take the doors off when cold weather approaches, it will be found that in time the hinge-screw holes will become so worn that the screws will

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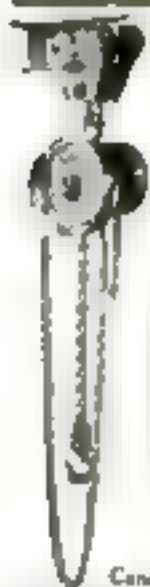
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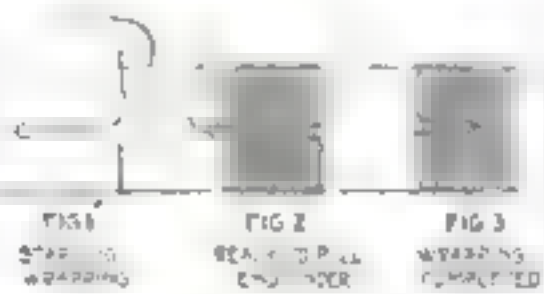
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fail to hold the hinges tight, thus allowing the door to sag. The remedy in this case is to use thicker or longer screws, or to stop the holes with hardwood plugs and fastening-hinges in the hardwood. Either plan will make a satisfactory job.—W. S. STANDIFORD.

How to Tie the Invisible Armature Knot

AFTER the armature of a motor has been rewound, and the leads have been soldered to the commutator, a wrapping consisting of a single layer of heavy twine is wound around the leads to hold them firmly in place. The action of the centrifugal force would otherwise tend to tear them loose when the motor's armature is rotating at high speed. The wrapping serves also as a protective covering for the leads. Incidentally it gives the winding a finished appearance when it is neatly applied. The appearance and ability to "stay put" depend upon the knot used to tie the ends of the twine. The so-called invisible knot has the qualities desirable for this purpose and is one of the little tricks of the trade used by all experienced armature-winders.

The method of tying the knot is depicted in the accompanying illustration. For the sake of clearness, the object upon which the wrapping is applied is shown merely as a piece of round rod, instead of the armature leads. The start is shown in Fig. 1. One end of the twine is doubled and laid along the length of the rod for a distance a little greater than the width



Illustrating exactly how the ends of the invisible armature knot are cut off

of the intended wrapping, in order to form the loop. Then, while the loop is held in place, the ball of twine is given several turns about the rod, a moderate tension being kept on it so that the first few turns will grip the portion of the loop over which they cross sufficiently tight to prevent its slipping. The wrapping is then continued until it covers the part intended. The twine is now cut, leaving a liberal end which is threaded through the loop and held taut with one hand, while the other end is pulled until the junction of the two loops thus formed is in about the center of the wrapping. Both the extending ends may now be cut off close to the end turns. Of course, an armature wrapping is given the usual several heavy coats of shellac which further improve its strength and appearance.—JOHN A. WEAVER.

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IN southern California electricity is very cheap, and, consequently, it is widely used. A great many people, however, are contented with the glaring, unshaded light hanging in the middle of the room. This is very hard on the eyes and, moreover, does not light the room properly.

The illustration shows one corner of a room in which a homemade, indirect-



Reflectors placed over your glaring electric lights will soothe your tired eyes and rest your nerves

lighting system is installed. The reflectors are ordinary washbasins coating 15 cents each. They were given several coats of white paint and finished with an enamel that dried with a gloss. Four lights were placed in the room, spaced symmetrically, so that an even illumination was secured. The reflectors were hung with ordinary iron chains purchased at a hardware store. The brass canopy to which the chains are attached was bought from an electrical supply house. The chains and basins were so arranged that the basins can be detached in a few seconds and dusted out, since it is very necessary to keep the reflectors and bulbs free from dust and dirt if one is to get good light. The ceiling should be painted white to get the best results.—N. O. MOORE.

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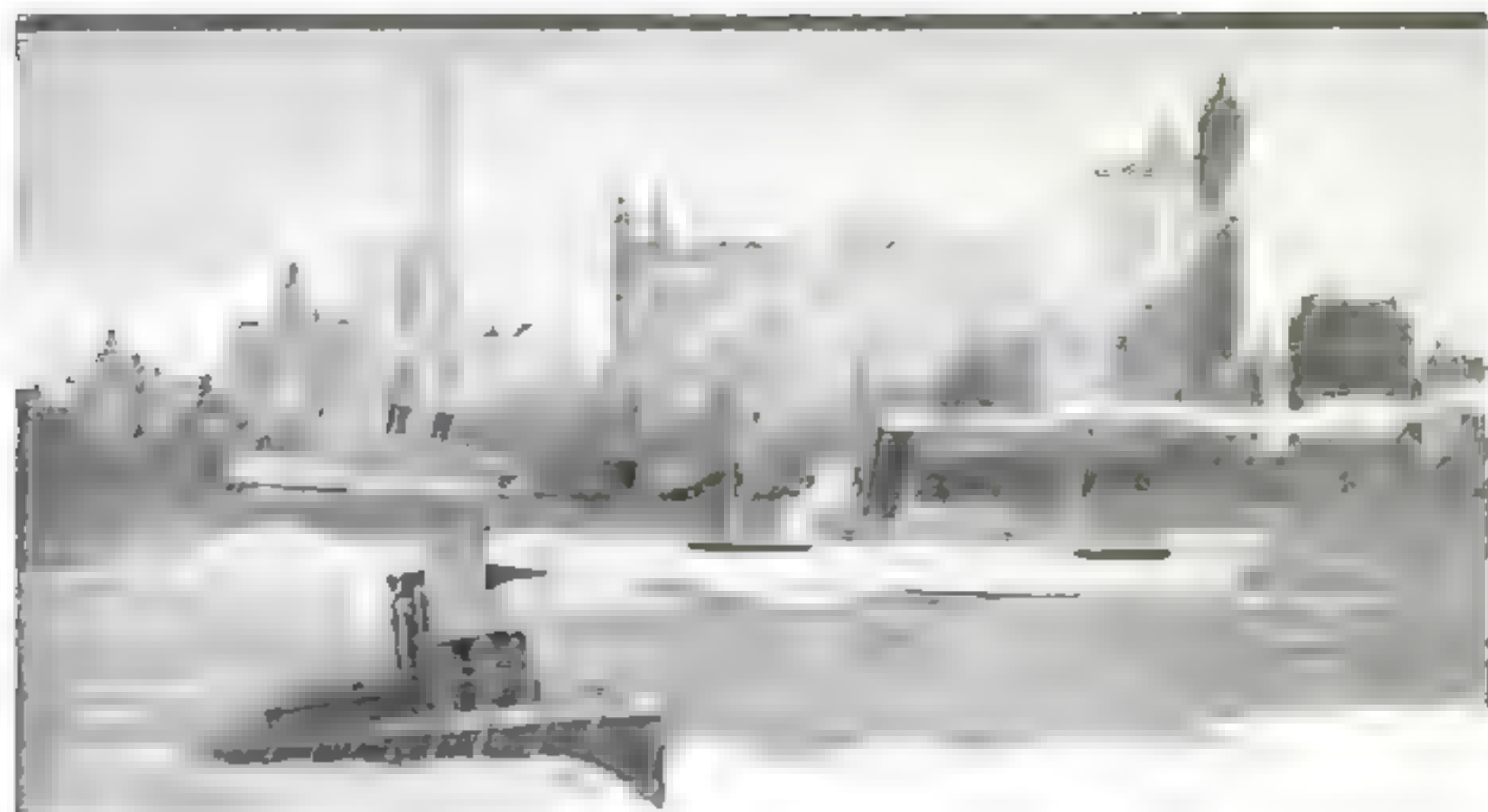
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To Make a Hand-Power Milling Attachment

AMATEURS often find it necessary to cut slots or key-ways in shafting or shaft ends, slit bushings for expanding mandrels, shape square or hexagon heads on small bolts, etc. work, that in the absence of a milling-

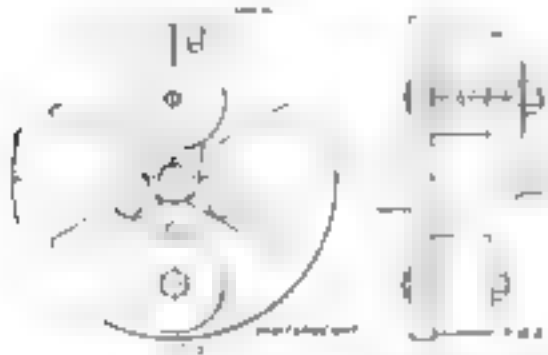
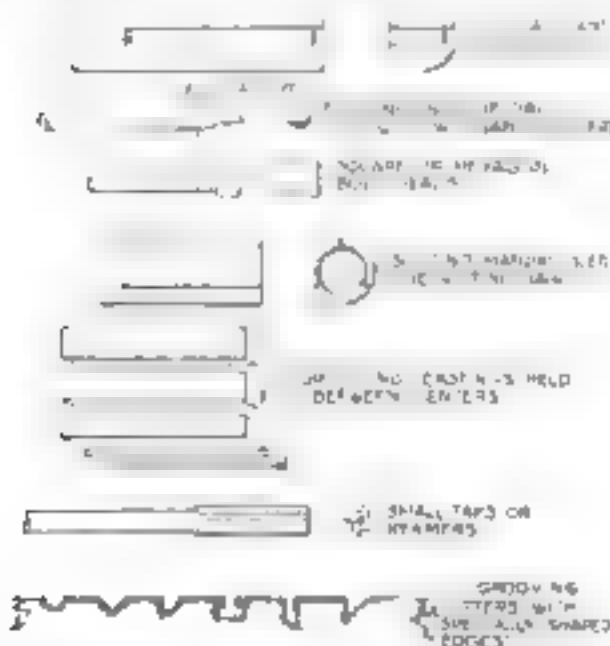


Fig. 1 and 2 show a method by which the cap and slide bearings may be bored

machine or shaper, must be done by hacksaw, file, and chisel, with more or less unsatisfactory results.

Here is a hand-power milling attachment that may be made complete on any small screw-cutting lathe. The key-way in the long upright column is cut by placing the column between centers, clamping the cutting tool on its side, and forming the keyway by running the tool-slide back and forth by hand. If shallow holes are drilled in series along the column before this operation, the process will be much easier on the lathe, as well as on the man who runs it.

No special dimensions have been given for these will depend upon the size of the lathe for which the device is built. But clearance should be given for cutters not more than 2 in. in diameter—it is impractical to use



The above illustration sets forth in detail the different parts necessary to make the milling attachment

anything larger for this small miller. As may be seen by the diagram, the device consists of a steel or cast-iron upright column, with a separate cap held on top by the bolt that clamps the column to the tool-slide of the lathe. This cap contains the upper bearing for the cutter spindle, the lower bearing being a casting that slides up and down on the column, adjusted by

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should be in line when the machine is assembled. If the holes are bored and reamed directly in the casting perfectly good bearings will result, bronze or babbitt bushings being unnecessary.

One form of operating handle is shown; a cast-iron arm and iron or steel handle turned up to fit it. For heavy work in cutting steel, a large tap-wrench may be fitted to the spindle in place of the crank, and both hands used to do the cutting.

In use, the device is clamped to the lathe-tool slide and the work held between centers, or, if the end is to be worked on, in the chuck or steady-rest. The cutter is fed to the work by means of the cross-slide and longitudinal feed given by hand to the tool-carriage. For end-slotting the cutter is fed across the work by the cross-slide. A good way to give an even longitudinal feed is to remove the feed-shaft gear and substitute a crank-handle, this being turned by one hand while the cutter spindle is turned by the other. For heavy work two persons are almost necessary, one to turn the cutter and one to manage the carriage; it would hardly be advisable to attempt a power feed unless the cutter were also driven by power.

This could be accomplished by building the column cap so that it would accommodate a worm-gear on the spindle-shaft, this being turned by a worm driven from an overhead counter-shaft. The spindle would have to be keywayed and a sliding key fitted to the worm, similar to the bevel gear drive on a drill-press spindle.

But for occasional work, such as the original is used for and such as the average amateur would do, this would be an unnecessary complication, the hand power having proved practical and allowing a great variety of cutting, grooving, facing work heretofore impossible of accomplishment on the lathe.—J. H. PARKER.

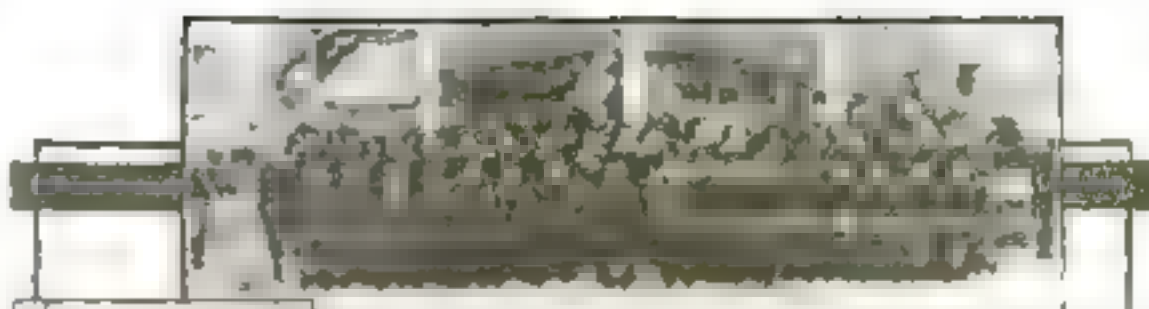
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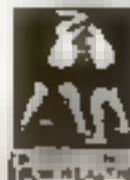


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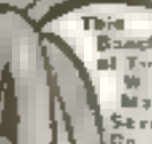
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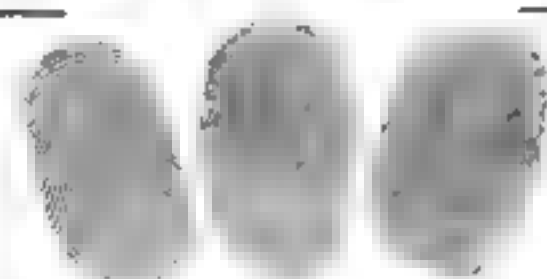
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(2) The method must be clearly shown either in a photograph or in a drawing. If a drawing is sent in, it need not be made by a skilled draftsman. It is sufficient that it should be intelligible. While pencil sketches will be considered, contestants are requested to make their drawings in ink on heavy white paper. The views should be sufficient in number to set forth the use of the appliance very clearly. The contestant's name and address should appear on each sheet of drawings.

(3) The drawings or photographs must be accompanied by a description, preferably type-written, in which the method is clearly given. It must be written on one side of the paper only, and it should not be more than 500 words in length. The name and address of the contestant should appear in the upper left-hand corner of the first sheet of the written description.

(4) The drawings and description entered by contestants must be received by the POPULAR SCIENCE MONTHLY not later than 5 p. m. on Saturday, July 31, 1920.

(5) The judges of the contest will be the editors of the POPULAR SCIENCE MONTHLY.

(6) The first prize of \$50 will be awarded to the contestant who, in the opinion of the judges, has suggested the simplest and neatest job.

The second prize of \$25 will be paid to the contestant who submits a method next in merit.

The third prize of \$15 will be paid to the contestant who submits the method third in merit.

(7) The winners of the contest will be announced in the earliest possible issue of the POPULAR SCIENCE MONTHLY. A description of the methods which win the three prizes offered will duly appear in the pages of the POPULAR SCIENCE MONTHLY, together with the names of the winners.

(8) The editors of the POPULAR SCIENCE MONTHLY shall have the right to publish meritorious manuscripts which do not win a prize. The regular space rates will be paid to the contestants who submit the manuscripts thus selected.

(9) When a contestant submits more than one method, the description and drawing by which each is set forth must be sent as a separate unit.

(10) Manuscripts or drawings will be returned to contestants if stamps are enclosed.

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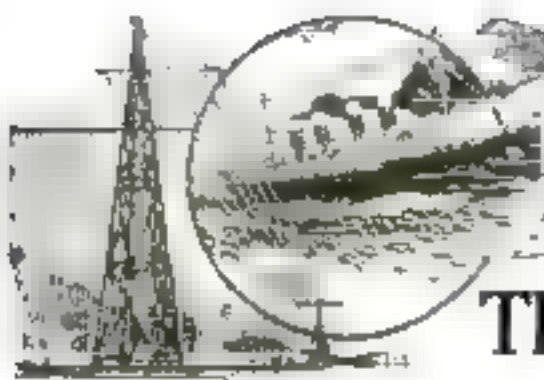
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For the Radio Experimenter

The Thermionic Oscillator—III

By H. J. van der Bijl, M. A., Ph. D.

THE principles involved in the production of sustained oscillations with the thermionic vacuum tube have been explained in the previous article. The circuits shown there have been stripped of all parts, such as the batteries, that are not necessary to explain the operation

of the tube in the production of oscillations. We shall now discuss some of the circuits actually used in practice, and here the batteries will be shown so that the diagrams represent circuits that can actually be used. There

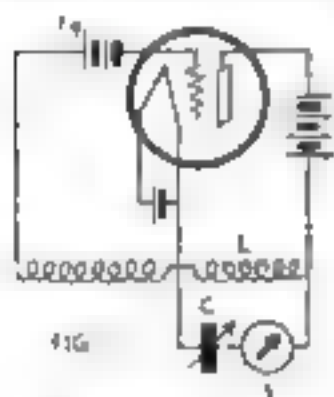


FIG. 1
The simplest type of vacuum-tube oscillation circuit is shown in this diagram

are a large number of different circuits in use at the present time, all of which are satisfactory, though some have advantages over others in certain respects.

Simplest Type of Oscillation Circuit

Fig. 1 shows the simplest type of oscillation circuit, sometimes referred to as the "reversed feed-back circuit."

This circuit lends itself most readily to mathematical solution, and is also in actual operation one of the simplest types. The oscillation current is established in the oscillation circuit LC and can be measured with the a.c. meter A. A grid battery E_g is inserted in the grid circuit to maintain the grid at negative potential with respect to the filament. This is not always necessary, it being possible to make the tube operate satisfactorily without the grid battery. But it will usually be found that in general there is a certain grid potential that gives the best results and that should be determined experimentally. The frequency of the oscillations is

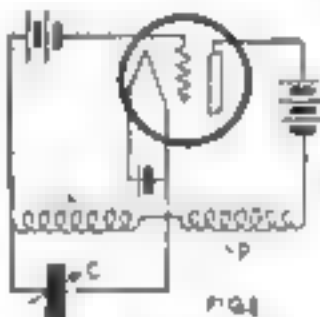


FIG. 2
This is the feed-back type of oscillation circuit with an inductive coupling

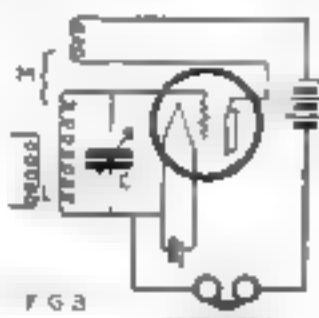


FIG. 3
The oscillation circuit shown in Fig. 2 is here adapted to radio receiving

determined almost entirely by the inductance L and capacity C in the oscillation circuit; in other words, it is given by

$$\text{frequency} = \frac{1}{2\pi\sqrt{LC}}$$

Fig. 2 shows the circuit that is generally referred to as the feed-back circuit. The difference between this and the other one is that the condenser is in parallel with the grid inductance instead of with the plate inductance. This circuit is the type that is used to detect electromagnetic waves by the autodyne method. When

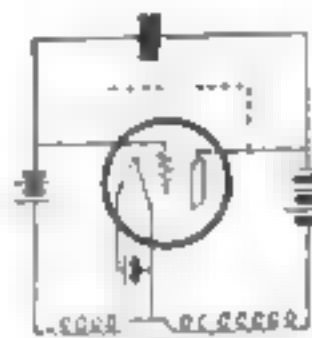


FIG. 4
Here is the Hartley oscillation circuit, designed for generating high frequencies

used for this purpose the incoming oscillations are induced in the coil L, while the resonant circuit containing C and L are tuned to the frequency of the incoming oscillations, thus producing maximum potential variations between the filament and the grid. The receiver may be inserted in the plate circuit, as shown in Fig. 3. It will be seen that Fig. 3 is the same as Fig. 2, except that Fig. 3 looks more familiar as the type commonly used to receive continuous waves.

The Hartley Circuit

A type of oscillation circuit that is commonly used is shown in Fig. 4. This is known as the Hartley circuit. This arrangement is of value when producing very high frequencies. The tube is not entirely free from reactance effects. There

is, for example, an electrostatic capacity between the grid and the plate of the tube, and so also between the other elements. These electrostatic capacities are usually very small, but they become very effective when the frequency becomes very high. The effective capacity between

grid and plate is indicated in Fig. 4 by the dotted line. In the Hartley cir-

cuit the condenser C connects the grid with the plate. It will, therefore, be seen from the figure that this condenser and the capacity between grid and plate are in parallel, so that they may simply be added. For very high frequencies the condenser C may be omitted altogether, and the tube will oscillate with a frequency depending on the inductance of the coil and the capacity between the elements of the tube.

In the arrangement shown in this diagram the grid is maintained at an appropriate negative potential by means of the grid battery E_g . The same thing may be done by means of a resistance leak R, as shown in Fig. 5.

As was before stated, this type of circuit is commonly used, and it will be found very satisfactory when it is desired to produce oscillations covering a very wide range.

There are two other types of circuit that should be mentioned here. The first is the Colpitts oscillation circuit, which is shown in Fig. 6. In this diagram the batteries are omitted for the sake of clearness. Comparing

Fig. 6 with Fig. 4, it will be seen that the inductance in the Colpitts circuit takes the place of the capacity in the Hartley circuit, and the inductances in the Hartley circuit are replaced by condensers in the Colpitts circuit. A convenient way to use the Colpitts circuit in actual practice is shown in Fig. 7. C_1 represents choke coils to pass direct current, the plate battery being inserted as indicated by E_p . The condensers C_1 and C_2 are added to prevent direct current from flowing through the inductance L. In other words, the choke coils and these condensers are inserted to separate the d.c. from the a.c. circuits.

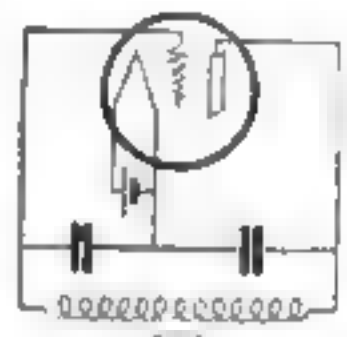


FIG. 5
The Colpitts oscillator shown above uses a single coil and two condensers

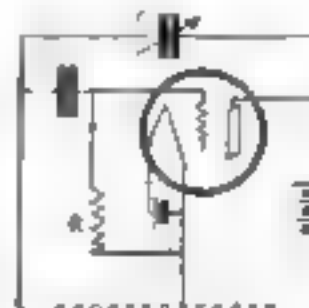


FIG. 6
The grid-leak oscillation circuit maintains a negative potential on grid

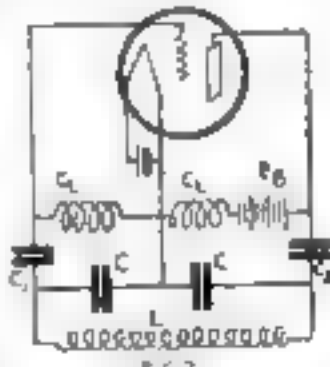


FIG. 7
Showing the battery supply circuits that are used for the Colpitts oscillation

Double tube frame and special spring fork

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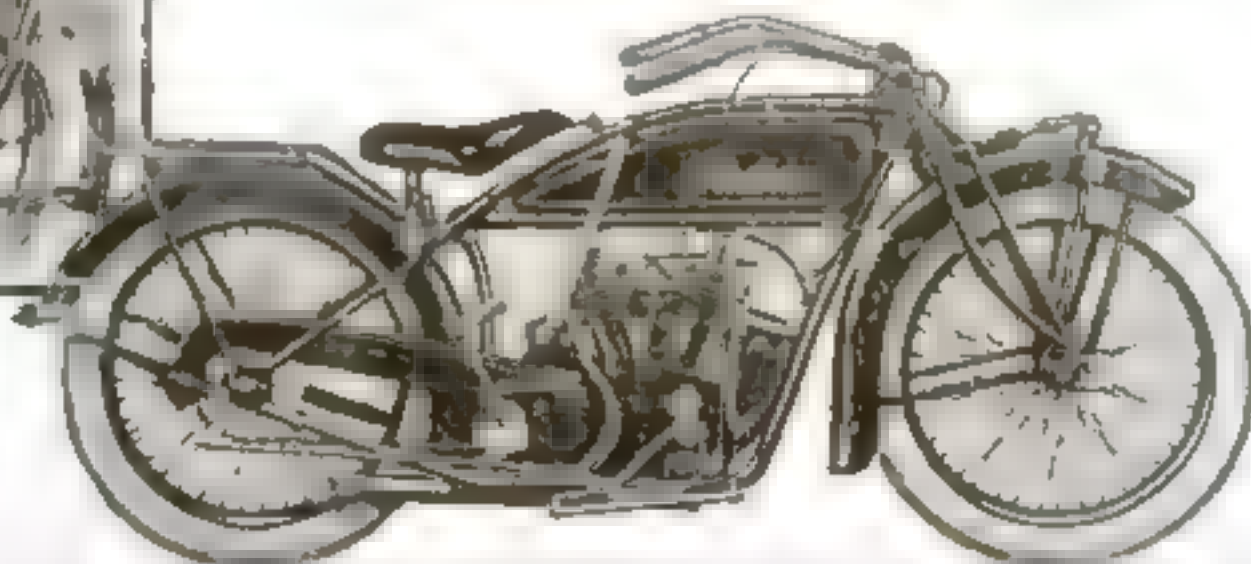
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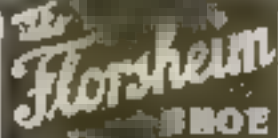


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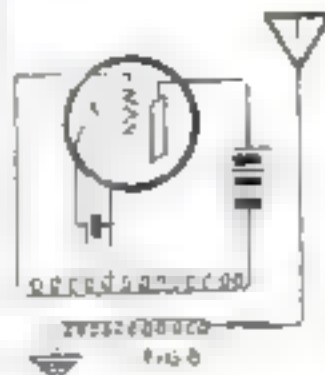
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When it is desired to impress these
oscillations on an antenna, any one of
the known means can be resorted to.
The antenna circuit may, for example,
be coupled up to the oscillation circuit.
Fig. 8 shows the Meissner oscillation



Showing the con-
nection of the Meiss-
ner or oscillation cir-
cuit to the antenna.

circuit and the
way in which it
is coupled to an
antenna.

In order to
obtain the best
results, it will
usually be
found nec-
essary to adjust
the filament
current and the
plate voltage
to certain val-
ues that, under
the conditions
of operation,

will give the best results. If the fila-
ment current is not high enough, the
tube will give a small amount of power
output in the form of alternating
current, or it may not oscillate at all.

Increased Current

As the filament current is in-
creased, the tube will suddenly start to
oscillate when a certain value of fila-
ment current is reached. As the fila-
ment current is further increased, the
strength of the
oscillation cur-
rent (as meas-
ured, for exam-
ple, by the am-
meter A in Fig.
1) will increase
rapidly at first
and then more
slowly, and fin-
ally become
virtually inde-
pendent of the
filament cur-
rent. This be-
havior is shown in Fig. 9, which gives
the out-power as a function of the fila-
ment current. The filament current
should not be made any greater than
is necessary, because this unduly
shortens the life of the tube.

Now, suppose the filament current
has a fixed value I_f . Unless the plate
voltage is large enough, the tube will
not oscillate,



The power output de-
pends upon the plate
voltage, as shown here

even though the
filament current
is large enough.
Fig. 10 shows the
relation between
the output power
and the plate
voltage. It will
be seen that the
output power re-
mains zero until
the plate voltage
reaches a certain value. Further in-
crease in the plate voltage causes a
rapid increase in the output power,
provided the filament current is high
enough. The plate voltage should be
kept within certain limits, depending
on the type of tube.

The power output
is bound to vary
if filament current
is too low

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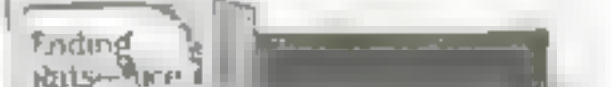
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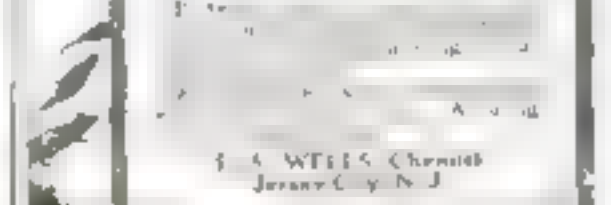
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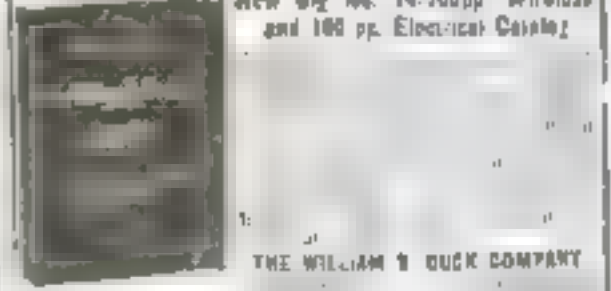


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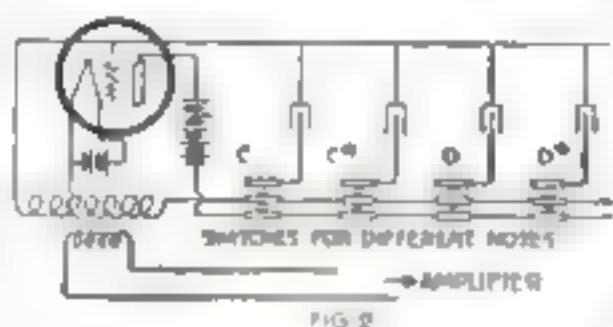
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If you are using a relatively large value of inductance, as you should to obtain a good "stiff circuit," you can wind over it quite a large number of turns of fine wire to couple to the amplifier tube. It is well to supply the battery of the amplifier through a choke coil, and to take off the alternating current through a condenser, as shown in the figure. Don't use a tube with too great amplification, in either



When you have properly chosen the values of L and C to give the notes you wish, you may arrange a switching scheme like that of Fig. 2. Each switch is a double-contact key like that of Fig. 3. In this circuit you will notice that closing any switch first connects the properly tuned circuit and then closes the plate circuit and allows the tube to oscillate and this produces the corresponding musical sound or note.—TEN BROEKE.



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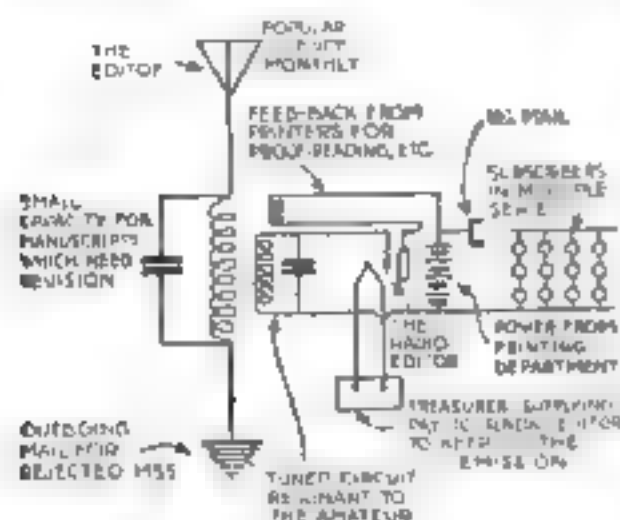
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siderable inductance. The retarding effect is sufficient to prevent anything good getting by him and reaching the other terminal, which connects to the outgoing mail for rejected manuscripts. In his present hook-up a small capacity, formed by a desk drawer, serves to hold contributions that have merit but won't quite do. Some of these he revises. At present it is about ready to break down or to spark over because of a heavy charge of hand-written manuscripts. The compositor objects to these even more than the editor does. If your contribution seems to you worth while, borrow a typewriter and make it look that way.

Coupled with this primary is a circuit sharply tuned to new ideas in radio and resonant with sympathy and interest in the progress of the amateur. There is no "bug trap" or X-stopper, and sometimes the circuit gets a bad jolt. Amateur B sends in a diagram, involving the same principles, but a slightly different hook-up, from the one that the editor has just accepted from amateur A for publication next month. Mr. A gets the check and Mr. B. a rejection slip. There's a damped oscillation of sympathy for the latter. You hope he'll come again.

Then your grid gets blocked with questions from novice X, six at once in lead-pencil on a half sheet of paper and enclosing stamp for immediate reply. X, Jr., wants to know what tube will give the best amplification. Has he read Dr. van der Bijl's articles, which we are featuring? What tube shall we tell him, without seeing his circuit or knowing what he wants to amplify? Then he wants to know what is the limit to the amplification that can be obtained. About here the old tube starts to go bad, or at least to talk that way.

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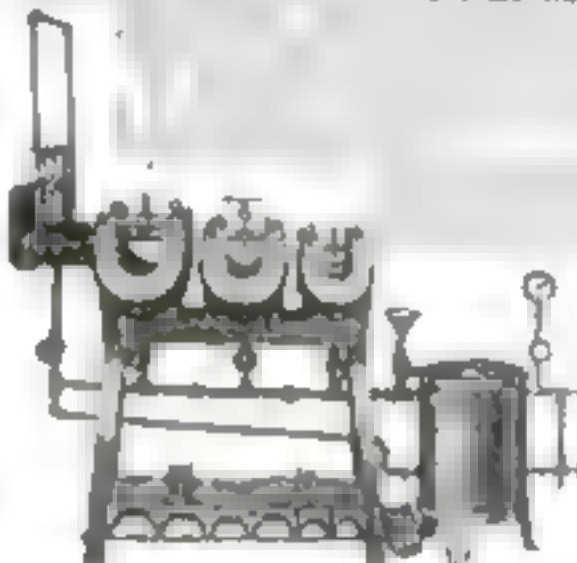
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Popular Science Monthly, 225 W. 39th St., New York

artists, so the circuit is really regenerative. Of course, the tube acts not only as a detector of good stuff, but also as an amplifier; for some contributions need that.

What's our record in words per minute? We don't know, but if your contribution is more than four hundred words, exclusive of photos and sketches, we'll probably beat our record, but we'll use a blue pencil. Don't forget the photographs, and then condense your article into about this number of words, and give some other amateur a chance to get his stuff into the same issue.

Radio Equipment for Pleasure Craft

EQUIPMENT of small boats and pleasure craft for radio has been made entirely practicable by the development of the transmitter shown in the accompanying photographs. This apparatus has been designed to include all the latest features found in a merchant vessel's equipment, but is so ingeniously constructed that the entire transmitter is contained within a case no larger than a typewriter. The weight has been kept down to a trifle over forty pounds.

The principal value of a set of this character lies in destroying the isolation of cruising waters for the owner who operates his own boat. Designing the set for compactness required the elimination of intricate electrical circuits, and this has been so well accomplished that an inexperienced person can learn its operation after a few hours' practice. Only one adjustment of the transmitter is required, and manipulation of the receiver is equally simple. Thus, after a brief experience with adjustments and about thirty hours' practice at home in learning the telegraph code, the amateur yachtsman is ready to avail himself of the great convenience of having a thoroughly reliable means of communication at hand at all times. With this equipment he may receive the



Rear view of the panel of a new radio transmitter designed for pleasure-craft service

daily storm warnings, news of menaces to navigation, time signals by which to check his chronometer, and may gain lost bearings in fog or storm, communicate with passing vessels, and on



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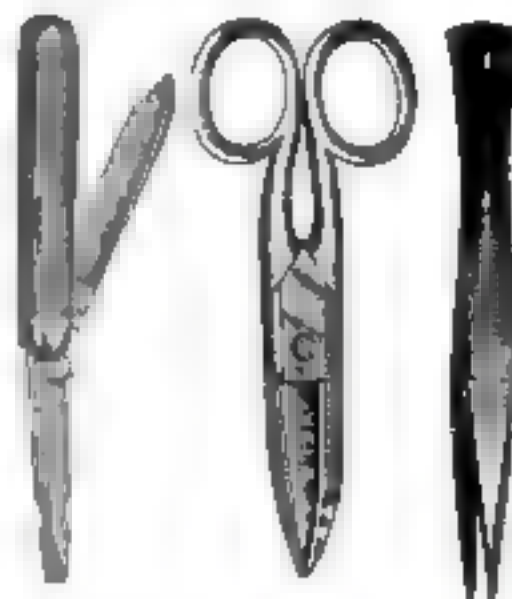
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strument as seen from the illustration.
Most any cuplike piece of metal may
be used for the grid. The writer
employs two styles, one for a tubular
and the other for a round bulb. The
former is made from a speaking-tube
mouthpiece of nickel-plated brass that
just fits the bottom of the bulb. The
latter may be a silver-plated mustard-
pot guard such as can be bought for
twenty-five or fifty cents.

The external grids are connected
with binding-posts in the usual man-
ner. The circuit employed with any



In this detector an old silver mustard-
pot guard serves for an external grid

of these bulbs is the standard circuit
used with external grid detectors.

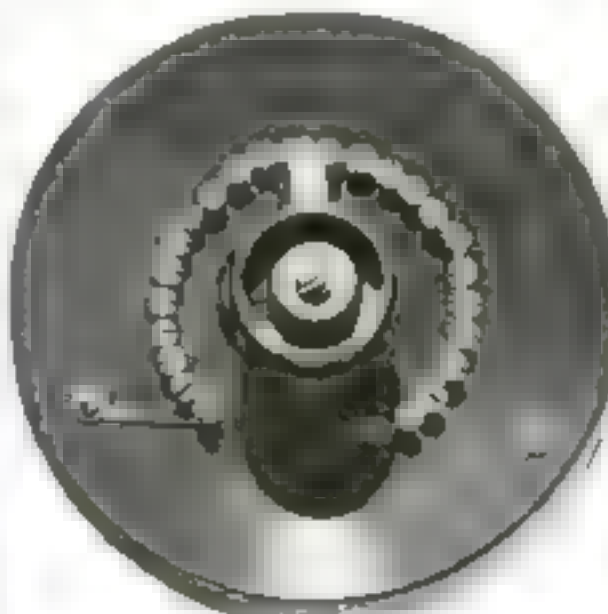
A point to be remembered in using
these valves is that the larger the grid
employed the smaller the grid con-
denser must be, since the grid itself is
in effect a condenser.

These bulbs, being of the "gas"
type, require a critical adjustment,
but when this is reached are very
sensitive.—R. U. CLARK, 3rd

Variable Grid-Leak in a Novel Mounting

THE grid-leak is an instrument so
simple as it is useful, but it should
be variable for experimental purposes.
The simple instrument shown here
permits a wide variation of resistance,
and may be readily made. The switch
is made up from an old record and
some screws, as shown.

If a small disk record is used as a
base, the contacts should be made of
short screws, which can be heated and



This simple grid-leak, permitting a wide
variation of resistance, is easily made



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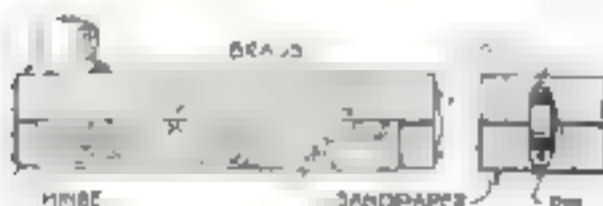
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A Simple Sandpaper-Holder for Carpenters

CARPENTERS, and other people whose work involves much smoothing, will find very useful a block such as is shown herewith, which will hold the sandpaper and allow the sheets to be changed.

Two blocks of hard wood of sufficient size are hinged together at one end. Near the hinge on the upper



Just snap the sandpaper beneath this block and you have a holder for sandpapering whenever you have the desire

block is fastened a round knob for a hand-hold. At the opposite end of the blocks is fastened a stiff spring of the shape indicated, with a hole in the lower end which will snap in place over a metal pin in the lower block. This holds the blocks tightly together but they can be separated by unsnapping the spring.

Drive several little brads in the bottom face of the upper block and file off the heads so that they will be pointed.

Place a sheet of sandpaper around the bottom block and bring the ends up, lapping them over the top of it. Then snap the top block down in place and the sharpened brads will be forced through the paper and will assist in holding it firmly in place. When this paper is used up, a new piece can be quickly inserted.—L. B. ROBBINS.

A Battery-Connector of Sheet Metal

A BATTERY-CONNECTOR made of sheet metal is a necessity where the batteries receive rough usage and the insulation is liable to constant wearing. A connector that can be quickly constructed is here illustrated.



Make your battery connectors of thin copper or brass. They last twice as long as the ordinary kind of connectors

Cut out a piece of thin copper, brass, or tin about $4\frac{1}{2}$ in. long, and $\frac{3}{4}$ in. wide. At each end cut slots across the width of the metal and about the shape indicated. Have them on opposite sides. Round the ends and then wrap all the piece except the slotted ends with electric tape.

Several of these connectors in the tool-kit will be found very useful in emergency cases and they will last forever.—WINDSOR CROWELL.



Ask any carpenter

JUST ask any carpenter who has used one, what he thinks of the Sargent Auto-Set Bench Plane. He will tell you that it's a superior plane in every respect.

Sargent Framing Squares

SARGENT Steel Framing Squares are the only squares which will calculate the lengths and cuts of Hip, Valley, Jack and Common rafters, without any figuring on the part of the carpenter.

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It cuts fast and cuts true, without any chatter. The cap iron and clamp are fitted together as one piece, with a set-screw to regulate the position. Another set-screw adjusts the cutter.

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The above Revolution Set Back Counter records the output of any machine where a shaft revolution indicates an operation. Sets back to zero from any figure by turning knob one round. Supplied with four to ten figure wheels as required. Price with four figures, as illustrated, \$9.00. List. Cut less than one half size.



The Number 14 Ratchet Counter at left registers one for each throw of the lever, recording number of machine operations. Supplied with outside stops which regulate

the throw of the lever and having return spring action which automatically returns the lever into position for the next count. The lever is adjustable, allowing the counter to be used at any angle. Price \$2.25. Cut nearly full size.

Most any machine you're interested in can be equipped with a Veeder Counter, the new Veeder booklet shows styles and sizes for all purposes. Copy on request.

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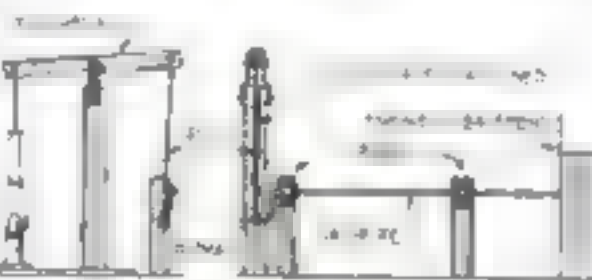
Baffling the Ingenuity of the "Tool-Borrower"

MANY mechanics make it a practice to mark their tools in some manner for purposes of identification in case they are "lost, strayed, or stolen." This policy is a good one, and the usual procedure of stamping the initials of the owner on the metal with a center-punch, or otherwise recording them in a conspicuous place, is all right so long as the party accidentally or purposely coming into possession of the tools has no evil intentions. However, if the missing article is "borrowed" by one of those individuals never averse to adding to their tool collections at the expense of others, it is simply introduced to an emery-wheel or file, and the evidence of former ownership is lost.

Now, if one takes the trouble to mark his tools at all, why not put the marks where they are least conspicuous, or better still, where they cannot be seen at all unless some part of the tool is first removed? Take, for instance, the usual form of Stillson wrench with the removable wooden handle. It takes but a few moments to remove the nut, slip off the handle, mark the tool, and replace the handle and nut again, and it's just ten to one the other fellow won't think of looking under that handle for identification marks. The handle of a hand-saw can likewise be easily removed and replaced and many other valuable tools offer convenient hiding-places for the owner's initials.—J. A. WEAVER.

This Obliging Engine Pumps Water at a Distance

ALTHOUGH firmly bolted to its bed in the basement, a small gasoline-engine has been pumping water from a pump in the back yard



No need to have the engine on the scene of operation if you connect it as shown

for two years on a certain southern farm.

The illustration shows how the pump and engine were connected. A hole was drilled through the concrete foundation on a line with the end of the line-shaft already arranged in the basement near the wall. A number of 6 by 6 posts were then set in the ground on a line with the shaft, and extending to a point in line with the pump. The posts were bored with a 2-in. auger. A piece of 2-in. gas-pipe served as a shaft; it was secured to the end of the line-shaft in the basement, and provided with a pit-man at the other end. This was then

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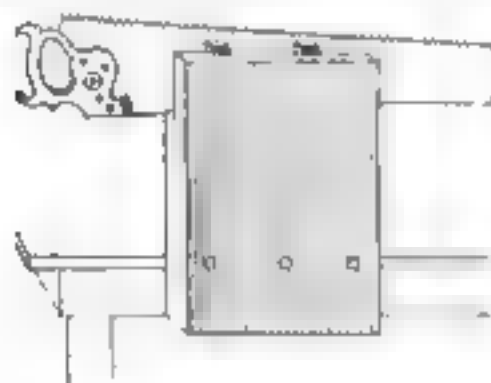
connected with a cross-beam made of a 2 by 6 piece of hard wood long enough to reach from a point over the pitman to the pump shaft; it was connected by a stiff iron rod and strap-irons.

Adjusting the length of the pitman and the bearing in the middle of the cross-arm regulated the stroke of the pump.

It was only necessary to start the engine in the basement, and in a moment water was flowing from the pump to the trough or wherever else it was desired.—DALE VAN HORN

To Make a Block of Timber Serve as a Vise

IF no commercial saw-clamp is available when the saw is to be sharpened, a makeshift arrangement is possible. Rip a block of timber open with



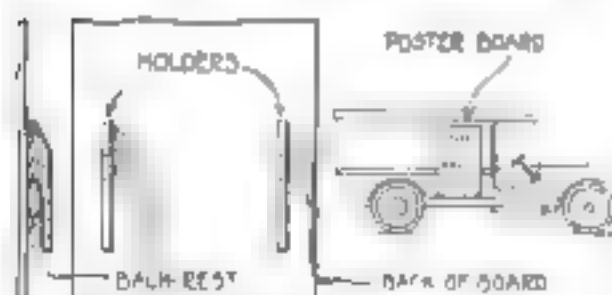
Saw open a plank, insert the saw, clamp with two pegs, and you will have a saw-vise

the saw; insert the saw, back downward into the groove; drive two wooden wedges in to hold the implement securely. The block may be nailed to the end of a work-bench. The saw-clamp—the product of mechanical forethought—is complete.

Detachable Poster-Boards for Motor-Trucks

ONE enterprising agent for a motion-picture concerns advertised recent picture releases by pasting the posters on detachable boards which fitted on the sides of his truck

Wooden holders, or cleats, were



Why paste posters all over the sides of your truck? Make removable boards and change the posters when necessary

screwed to the back of the poster-board, these being so shaped as to permit their fitting over a board projecting from the side of the body. In this way the boards were set in place and removed at will.

Doesn't this idea suggest a way to increase your business?

To cut down the cost per cut

250% More Work

In power back sawing, compound acts more as a coolant than as a lubricant. Cutting heats the blade, and the purpose of the compound is to prevent the temper of the blade being drawn.

A few drops of oil or a steady flow of compound simply tends to hold the chips in the cut and is frequently responsible for broken blades. Whatever you are using for a coolant, compound, or water, see to it that the work is flooded except when cutting iron castings. If you use compound, keep it thin and well agitated. Actual tests have proven that the use of compound will increase the amount of work accomplished by 250 per cent.

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1 H.P. 170 volts, 1000 rpm, 1/2" shaft, 1/2" lead out - \$76.50	2 H.P. 170 volts, 1000 rpm, 1/2" shaft, 1/2" lead out - \$46.50	2 H.P. 170 volts, 1000 rpm, 1/2" shaft, 1/2" lead out - \$96.00	200 amp. 6.0, 120 volts, 1/2" shaft, 1/2" lead out - \$68.50
1 1/2 H.P. 170 volts, 1000 rpm, 1/2" shaft, 1/2" lead out - \$116.50	3 H.P. 170 volts, 1000 rpm, 1/2" shaft, 1/2" lead out - \$78.50	3 H.P. 170 volts, 1000 rpm, 1/2" shaft, 1/2" lead out - \$112.00	250 amp. 6.0, 120 volts, 1/2" shaft, 1/2" lead out - \$88.50
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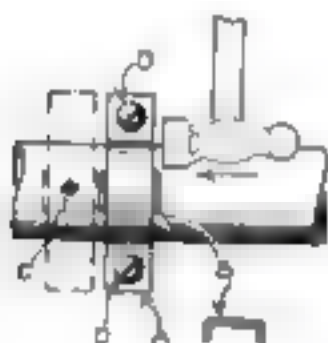
The centers are correctly aligned; if the distance varies, the centers are out of alignment.

So many young men take shop work nowadays that some of them will no doubt be interested in making the test in order to learn what degree of accuracy to expect.—H. C. RIDGELY.

How to Make a Quick and Lasting Pipe Repair

USUALLY it is at the most awkward moments that accidents occur. It was at such a moment that without warning one of our steam-pipes burst. It was impossible to shut it down at the time, for that would have entailed considerable loss; so our handy man rigged up the scheme shown in the illustration.

He took a two-part clamp, A, and



An emergency repair for a leaky pipe if made this way will last a long time

placed in this a bent piece of thin iron, B. Next to the piece of iron he placed a piece of packing, close to the hole, C, in the pipe. He then drove the complete arrangement on with his hammer and tightened up on the bolts, D. This made a good solid repair until we had time to put in a new piece of pipe.—J. H. MOORE.

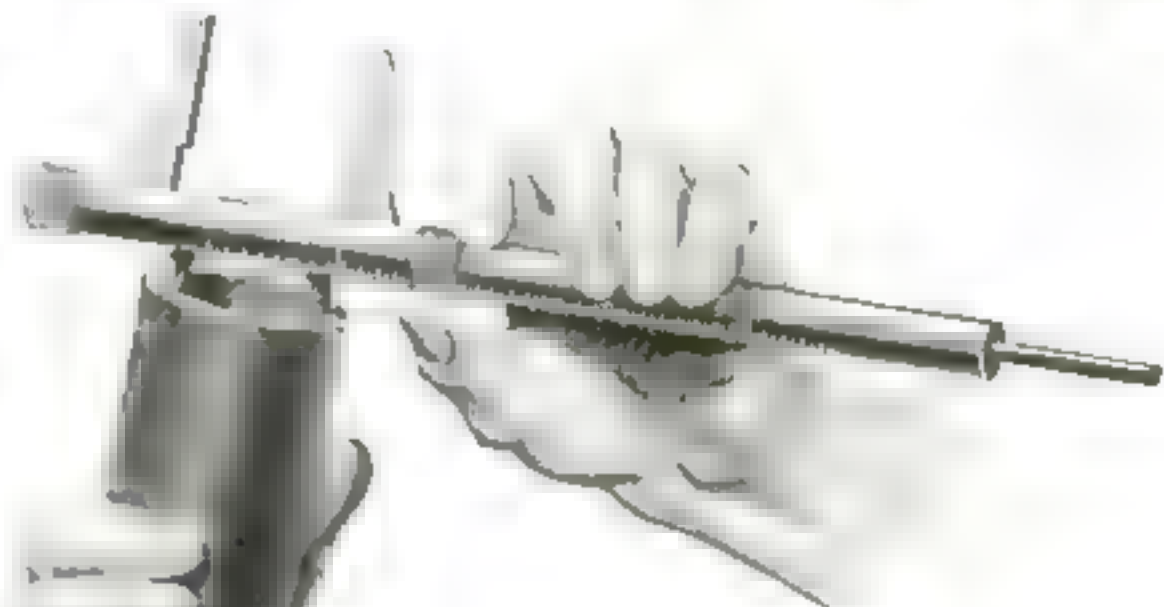
How to Make Quick, Smooth Erasures Without Swearing

IT is a remarkable fact based on wide observation, that about one draftsman in five hundred knows the proper way to make an ink erasure on paper or tracing cloth, though the proper way is absurdly simple. The average draftsman wrestles with his eraser murmuring oaths at himself for making his error. He wonders why he must rub hard and long till his paper or cloth wears thin or tears through, why the erasure is so uneven, why the cloth stretches and leaves a bad-looking spot. It apparently never occurs to him that his drawing-board, covered with thumb-tack perforations, presents a very irregular surface upon which the paper or cloth is unevenly pressed by the erasing operation.

What is required for a successful erasure is a smooth, hard surface to bear upon. A sheet of glass is probably the best expedient but if this is unobtainable every draftsman may at least insert his celluloid triangle under his paper or cloth at the spot where the operation is to be made.—C. NYE.

GOODELL-PRATT

1500 GOOD TOOLS



Universal Caliper

Three Tools in One

This useful tool takes the place of an inside caliper, outside caliper, and a depth gauge. You do not have to change tools. You can take either an English or a metric reading as soon as the measurement is made. The jaws may be locked in any desired position by a thumb-screw.

With the Universal Caliper you can make any inside, outside, or depth measurement to 4 inches or 10 centimeters. It is graduated on one side in sixteenths of an inch, and on the other side in millimeters. The jaws can be easily adjusted to compensate for wear. Length over all, 7 1/8 inches.

Price, \$2.50

This useful tool has all the merits which distinguish the 1500 different Goodell-Pratt Tools. Ask your dealer to show you this Universal Caliper, or write us for a complete description of this or any other tool.



Tapping Small Pieces in a Drill-Press

IN a certain shop where By John A. Weaver electrical medical bat-
teries and testing instruments are
manufactured, considerable quantities
of small brass nuts of varying sizes
and threads are used. These nuts are
of the punched
variety, and the
process whereby
they are tapped
out with rapidity
and slight ex-
pense is interest-
ing.

The tapping is
done in a drill-
press, by the aid
of a "long tap"
with a shank
several inches in
length, and an
easily made jig to
guide the nuts
under the tap
and hold them
in position. This
jig consists of a

rectangular block of cast-iron about 1
in. thick, with one side planed off
smooth and square. A hole of the
proper size to admit the tap with
a little play, is drilled through the
block at a point in the center of the
width of the block and close to one end
of its length. Narrow, flat strips of
steel, slightly thicker than the material
used for the nuts, are screwed to the
face of the block with machine screws
in the manner depicted in the illustra-
tion. The two short strips adjacent
to the hole are spaced so that the nut
to be tapped will slide easily through
the space between them. When the
nut is against the back strip, it should
be properly centered, the hole in nut
and block being in alignment. The
two longer guide-strips fan out to pro-
vide a space where a number of the
nuts can be placed, so that they can be
slid one by one with ease and rapidity
into the narrow portion and up against
the back strip. The action resembles
having the nuts in a hopper and feed-
ing them singly under the tap.

In operation, the cast-iron block is
securely clamped to the drill-press
table so that the hole in the block is
directly under the tap. The spindle of
the drill-press is run at a moderate
speed, and a quantity of nuts is
dumped into the hopper-like space
between the guide-strips. With one
hand, one nut at a time is slid into
position over the hole in the block;
with the other hand, the drill-press
spindle is operated. After the threaded
portion of the tap has passed through
the nut, the nut will slide up on the
shank of the tap. This will continue
until the shank of the tap is full of nuts
right up to the jaws of the chuck; then
the tap must be removed from the
chuck and the tapped nuts stripped off
the tap into a waiting receptacle.
From 20 to 30 nuts can be tapped be-
fore it is necessary to strip this tap,

the number of nuts de-
pending of course on the
length of the tap. The threads will not
be perfect unless the pressure used
in feeding the tap against the work
is rather light; usually the weight of
the handle operating the feed of the
spindle is sufficient. As there is no slow
and tedious backing out of the tap after
going through a nut, this scheme is
a real time-saver. After a little prac-
tice, anyone can very easily turn out
perfect nuts with considerable speed.
It is obvious that the scheme will be
effective also for tapping many small
pieces other than nuts.



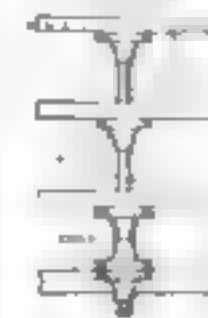
Here is a novel way
for tapping small
metal pieces in a
rapid drill-press

A Homemade Stand for the
Machinist's Tools

A USEFUL stand for holding the
small tools and appliances that
accumulate in any shop is easily made
as here shown. The plan has the ad-
vantage that it permits of extension, so
that it can be made as large as desired
within reasonable limits.

The stand is built around a central
support of common pipe and fittings.
The only fittings required are short
pieces of pipe, or long nipples, and
flanges. Have the pipe-fitter run a tap
through the flanges, so that the pipe
can be screwed in from either side, and
have the pipe threaded at both ends.
For the bottom section use a short
piece of pipe or a long nipple, and screw
it into a flange on the flat side. Attach
another flange to the first by means of
a close nipple, turning the flange so
that the flat side faces the opposite
way from the first flange.

To the second flange fasten a shelf,
which may be of any desired shape.
Make a hole in the center of the shelf
large enough for the pipe to pass
through, and screw in a second section
of pipe, then put on another flange,
another shelf, and so on until there are
as many shelves as desired. Put hooks
in the edges of the shelves for such tools



The stand is
built around a
central sup-
port of com-
mon pipe and
a few fittings

as can be hung up; the
others may be placed on
the shelves. A ledge
around the shelves will
prevent the tools from
sliding off. Flanges may
be obtained already
drilled for screws.

To support the stand
and permit it to re-
volve, sink a flange in
the bench at the point
where the stand is to
be placed, and ream or
file out the threads so
the short piece of pipe at the bottom
of the central support will pass through
easily, though with no looseness. Be
sure to place the bench flange with the
flat side up. It will probably be neces-
sary to level the surfaces of the flanges
with a file to make them work
smoothly together.

The dimensions are arbitrary



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quality of Williams' Superior Drop-Forgings.

And this highly developed, technical skill
is not acquired in a day. It is not a mush-
room growth. The serving an apprenticeship
of years before he is considered to have
developed the technical standard of expert-
ness as a craftsman, a man who has
worked in Williams' plant for fifteen years is
considered a mere youngster to man with
ten or twelve years, thirty or even thirty-
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PEYD-RPL-LTE3



Brunswick

PHONOGRAPHS AND RECORDS



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HARDLY had Brunswick records been announced than orders came in from all parts of the country—an avalanche of orders.

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Something different in records

JUST as we brought advancements in phonographs when we introduced The Brunswick several years ago, so do we again contribute to better music through improvements in recording.

We come with Brunswick Records at a time when reproduction seems to have reached perfection. But you will quickly appreciate the betterments. We felt 'midst all the wonderful advance of modern recording, that there was still a final development, one that would bring complete synchronization.

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Pictured here are some of our great artists—famous the world over. Their selections on Brunswick Records set new standards. Hitherto hidden qualities are now brought out sympathetically.

Each Brunswick Record is interpreted by a noted director or an accomplished artist technically trained in the art of recording.

Thus we bring that rare charm into Brunswick recordings which you will recognize instantly.

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We're sure you'll want to add many Brunswick selections to your collection of records.

Remember, Brunswick records can be played on any phonograph with steel or fiber needle.

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Virginia Ren
Coloratura Soprano



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THE easiest and quickest way to repair leaks in radiators, pumps, water jackets, motor head gaskets, hose connections, etc., is with Johnson's Radiator Cement. It will stop leaks in from two to ten minutes without laying up the car. It requires no experience to use Johnson's Radiator Cement—all you have to do is to remove the radiator cap and pour the Radiator Cement into the radiator.

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